Title

Diversity under the microscope: Lessons for building belonging in interdisciplinary spaces from the Women in Imaging + Industry bootcamp

Authors
Esbin, Meagan
Blackmon, Lena

Publication Date
2023-04-28

DOI
10.1111/jmi.13188

Title: Diversity under the microscope: Lessons for building belonging in interdisciplinary spaces from the Women in Imaging + Industry bootcamp

Authors: Meagan Esbin[&] and Lena Blackmon[&]

[&]Biophysics Graduate Group, University of California Berkeley, Berkeley CA

Abstract

As scientific projects and labs benefit from increasingly interdisciplinary expertise, students and trainees find themselves navigating a myriad of academic spaces, each with its own workplace culture and demographics. A clear example is the interdisciplinary field of optics and biological microscopy which bridges biology, physics, and engineering. While Biology PhDs are now >50% women, men in physics and engineering fields still significantly outnumber women, resulting in an imbalance of gender representation among microscopists and other "tool innovators" in the interdisciplinary field of biological microscopy and biomedical optics. In addition to the cultural and cognitive whiplash that results from disparate representation between fields such as Biology, Engineering, and Physics, indifference from institutional leaders to implement equity-focused initiatives further contributes to cultures of exclusion, rather than belonging, for women. Here we elaborate on the motivation, structure, and outcomes of building a specific affinity-based bootcamp as an intervention to create an inclusive, welcoming learning environment for women in optics. Considering the presence of nonbinary, trans, and other gender minoritized scientists, we recognize that women are not the only gender group underrepresented in biological microscopy and biomedical optics; still, we focus our attention on women in this specific intervention to improve gender parity in biological microscopy and biomedical optics. We hope that these strategies exemplify concrete paths forward for increasing belonging in interdisciplinary fields, a key step towards improving and diversifying graduate education.

Minoritization of women in microscopy across academia and industry

Comprehensive gender equity in science and engineering has proven to be an elusive goal. One such barrier is a gender-based pay gap in the science and engineering workforce, through which women are underpaid in comparison to men[1] for their labor. Moreover, in addition to pay gaps, women in science and engineering also experience authorship and funding gaps in comparison to men[2,3]; the sum effect of these phenomena present significant challenges to the career success of women in science and engineering. The effect of such systematic and cumulative disadvantage, coined "the Matthew effect[4]," follows women throughout their entire working careers, resulting in gender inequality appearing most drastically at late and high-ranking career stages[1–3,5]. Further, women of color and disabled women not only face challenges in the form of gender biases, but also biases against those with disability (ableism)[6] and/or bias against racial minorities (racism); such cultures of bias and exclusion[7,8] serve to alienate women scientists from their disciplines. Though momentum towards gender equity has been building for some time, worldwide disruptions presented by the COVID-19 pandemic further exacerbate inequalities by hindering women's careers in new ways[9–13], the long-term effects of which are undetermined.

Here we decide to focus on the ways these inequities are manifested in the interdisciplinary field of microscopy. Indeed, though progress towards gender equity has resulted in greater demographic diversity in many scientific disciplines, few scientific fields have yet to reach true gender parity. However, as a field, biology serves as a rare counter example: more women are now granted Biology PhDs (53%) than men in the U.S. This is in stark contrast to the vast and continuing underrepresentation in many other STEM fields: women currently earn 37% of the PhDs in Physical Sciences, 28% in Engineering, and 27% in Mathematics and Computer Science (Fig. 1)[14].

Despite progress in some STEM fields at the PhD stage, gender gaps persist throughout career stages; in concordance, representation of women in microscopy careers remains far from equal both in academic and industrial careers. For example, only 34% of UC Berkeley's faculty in Molecular and Cell Biology are women, despite the PhD program being approximately half women[15]. Microscopy research at Berkeley falls across several departmental boundaries, but of the faculty affiliated with the interdisciplinary Biophysics graduate group doing research in "Molecular Microscopy and Optical Probes", only 5 out of 27 (19%) are women, similar to the percentage of women faculty in the Berkeley Physics department (14%)[15,16]. Within the global microscopy workforce, the 2017 International Society for Optics and Photonics (SPIE) Gender Equity report demonstrated that only 21% of early-career workers in optics and photonics are women, which drops to ~10% at late-stage careers[17].

Microscopy and biomedical optics are interdisciplinary fields. Interdisciplinary research is highly beneficial for fueling new innovations and addressing the world's biggest problems and correlates with higher levels of funding, citations, and long-term impact[18–20]. For women working in interdisciplinary fields like microscopy which lie at the cross-section of biology, physics, and engineering, demographics and cultures can vary widely and conflicting attitudes around the underrepresentation of women in biological microscopy and biomedical optics create unique challenges for DEI (Diversity, Equity, and Inclusion) efforts in the field. Firstly, some believe change is inevitable; however, the misconception of a preordained rise of representation of women over time without requiring external interventions undermines DEI efforts to do so and mirrors the psychological fallacy of racial progress as outlined by Kraus, Torrez, and Hollie[21]. Secondly, others actively resist targeted DEI interventions, such as one biology professor who justified their opposition arguing that focused efforts would "exclude motivated male students from participating", despite the fact that men comprise 79% of the early career microscopy workforce, and 90% of the late career microscopy workforce[17]. Institutions across the U.S. and U.K. have observed that advocacy for gender equity does not "exclude" men, but that men have an essential role to play in these programs' success, as well as the success of the gender equity movement in STEM overall[22–24], thus contributing to a body of research against the aforementioned professor's remark. So what factors may contribute to this backlash? Researchers at LSE identified that apathy, fear (of loss of status, of making mistakes around female colleagues, and of disapproval from male colleagues), and lack of awareness are the largest factors preventing men from engaging in gender equity initiatives[23]. We advocate that broad participation in the bootcamp across genders, including male students, and future efforts to persuade men to contribute to the planning and funding of these bootcamps would only further our efforts to build a culture of allyship with and advocacy for gender minorities in microscopy and biomedical optics. Finally, some try to minimize the imbalance in gender

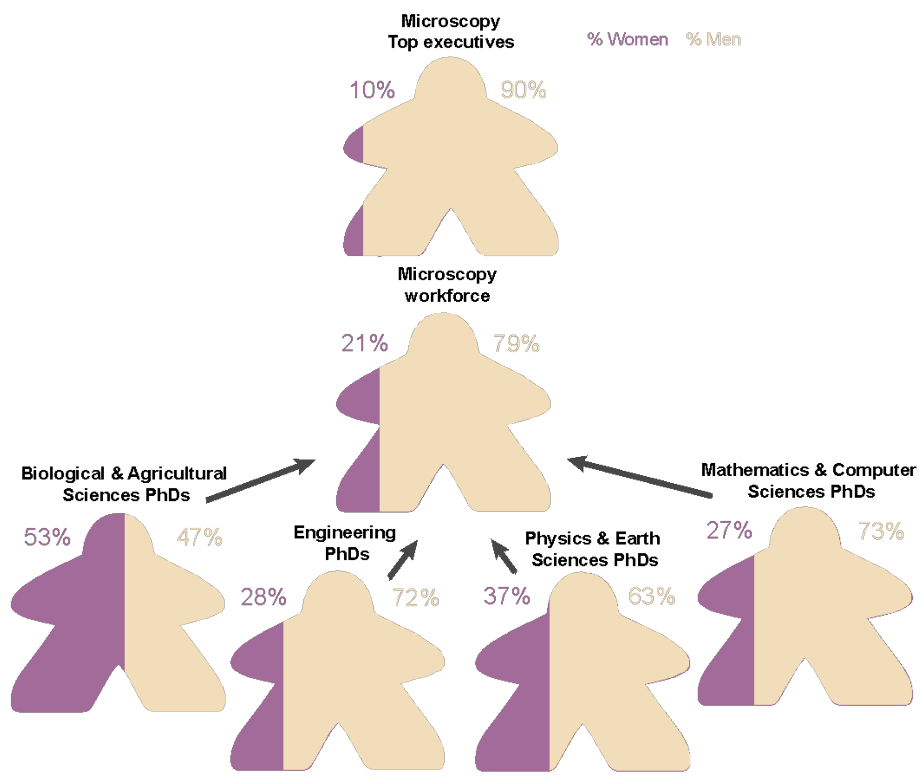

Figure 1. Gender representation in the microscopy workforce and the interdisciplinary PhD fields relevant to microscopy and optics.

representation in microscopy (for example, by focusing on gender-parity at the PhD level in Biology, while ignoring Physics, Engineering and the faculty/industry workforce demographics) while some hope to ignore minoritized identities entirely[25], which fuels resistance to interventions that specifically aim to address the challenges faced by minoritized groups in STEM. However, we advocate for interventions that remain laser-focused on addressing the specific hurdles for gender minorities in microscopy over a gender-blind approach. Tailored affinity-based programs, which can also be considered counterspaces[26], are crucial for providing inclusive learning environments in which women can access the tools necessary to excel in modern careers and cultivate belonging within interdisciplinary fields such as microscopy and optics.

Naturally, we acknowledge that bootcamps and tailored affinity-based programs are part of a broader strategy to address gender inequity and are not a “cure-all” for inequality. Holistic strategies will require participation across genders and among faculty, educators, and institutional leaders in order to prevent reproduction of existing ideologies and rewrite policies which reinforce inequity. Here we discuss in detail the implementation of one strategy, an affinity-based bootcamp for women in microscopy, as a tool to craft a better future for gender minorities in STEM[27,28].

Creating a bootcamp to build community and empower women in microscopy

To address the need for initiatives which promote the inclusion and belonging of women in microscopy, we created the Women in Imaging + Industry Applications bootcamp at UC Berkeley - an interdisciplinary bootcamp for incoming graduate students in STEM that specifically encourages building a safe, inclusive space, celebrates the contributions of women to microscopy, connects students with women role models in academia and industry, and leverages local networks to gain first-hand knowledge of women’s experiences in their career paths. We set up a bootcamp tailored to build community and celebrate women in microscopy and clearly stated our goals for the bootcamp on our flyer and materials: 1) Introduce students to basic concepts in light microscopy and discuss different imaging modalities and applications, 2) Foster community among women microscopists at Berkeley and in the Bay Area, and 3) Network with women microscopists at companies and understand how microscopy is applied for therapeutic or platform development. To address each of these teaching and belonging goals, our bootcamp structure was broken into three phases: 1) lectures and demos, 2) nano-rotations, and 3) company tours (Table 1). One bootcamp participant appreciated how each aspect contributed to her learning in a different way by noting, *"The lectures and mini-labs provided a useful understanding of the fundamental concepts that govern imaging. The academic guest speakers and opportunity to rotate in a new lab encouraged me to think creatively about how I could impact the field. The industry tours opened my eyes to an unfamiliar mindset and inspired me to adjust my own research approach. I feel that I now have the knowledge and tools to be a more capable scientist for both my current research and the many future questions I would like to tackle."* Our schedule was built to prioritize interpersonal connections between students and faculty with significant "meet-the-speaker" time built in after each faculty talk to give time for students to ask specific questions about their career paths and personal experiences in an informal setting, as well as inquire about rotations and collaborative opportunities. Another bootcamp participant explained the tangible benefit of these interactions by saying *"...microscopy [...] is a field in which learning occurs in a hands-on, almost apprenticeship model...the culture of image science and microscopy as a field is a double edged sword: the experts in the field are a small network of highly knowledgeable and enthusiastic researchers, making it a great field to conduct research-- once you get your foot in the door. Hence, incorporating speakers, nano-rotations, and physical tours/networking hours gave us an experience that served as that "foot in the door" into a new field."*

Day 1-3 Optics Fundamentals

10-10:30am	**Morning lecture** (Day 1 Welcome Presentation, industry speaker, etc)
10:30-12pm	**Fundamental optics lecture** Day 1: Lenses and sample prep - Ray diagrams, magnification, resolution, microscope hardware Day 2: Acquisition - Fluorescence, filters, lasers, cameras Data Analysis: Hands-on ImageJ demo + best practices
12-1pm	Lunch
1pm-3pm	**Hands-on labs** Day 1: Microscope lenses and alignment, safety + handling Day 2: Fluorescence, spectra, filters, power Day 3: AOTFs, controlling and measuring illumination
3-3:15pm	Coffee break
3:15-4pm	**Imaging modalities lecture** Day 1: Widefield, phase contrast, dark field Day 2: Confocal, multiphoton (2P), complex sample prep, tissue clearing Day 3: Single molecule - STORM, PALM, SIM, TIRF, light sheet, single molecule tracking
4-5:30pm	**Science Talk** (Faculty) + meet the speaker

Day 4-5 Nano-rotations in on-campus labs

Students were paired with graduate students and postdocs in participating labs across campus to learn new microscopy methods, sample prep, and data analysis hands-on

9am-5pm	**Nano-rotations**
12-1pm	Lunch

Day 6-7 Industry Tours

Industry tours generally included career panels with women at the company or the microscopy team, tours of facilities and equipment and casual time to network

9am-12pm	**Company tour #1**
12-2pm	Lunch + transportation
2-5pm	**Company tour #2**

Table 1: Women in Imaging + Industry applications bootcamp 7-day structure and topics covered.

When designing our bootcamp, we implemented several organizational strategies central to its success. Firstly, unlike many bootcamps offered, we chose to focus not only on providing academic support through teaching microscopy basics, but also career development support that allowed students to shape their graduate trajectory by seeking out industry internships, academic mentors, or collaborators early in their PhD. Secondly, we explicitly framed our goal to promote women in microscopy not only in our recruitment materials, but also through our "Welcome Presentation" held on the first morning of the bootcamp, to discuss statistics and research on gender inequity in microscopy, spotlight local and global women mentors and microscopist role models, and to advertise on-campus and national resources such as journals and extracurricular groups that support gender diversity in STEM. This lecture also outlined our course objectives and established respectful group norms in order to create an environment of purpose, belonging, and safety. Thirdly, to encourage students to create a broad network of grad student, postdoc, faculty, and industry scientist mentors, we incorporated networking opportunities in a variety of formats throughout the three-phase bootcamp structure including small-group laboratory sessions, one-on-one rotations, in-person and virtual lectures, and casual "happy-hour" sessions, that allowed students to network at varying comfort levels. Finally, to ensure that the structure and cost of our bootcamp was not prohibitive for participation, we raised funding from campus and graduate program sources to fully cover all costs of participation, transportation, and meals for all our students and to compensate instructors and course creators with stipends for their time, thus avoiding levying the "minority tax" on those creating and participating in diversity initiatives (minority tax citation). We chose to reduce costs and travel by having our bootcamp held on campus with local participants and using virtual lecture platforms to include non-local speakers.

Overall, participants brought enthusiasm and collaborative spirit to the bootcamp. After the conclusion of the program, when presented with a qualitative exit survey, multiple participants communicated gratitude for the creation of the program. Verbally, some participants expressed a commitment to continue the program on a biannual basis, creating a path for a sustainable intervention towards the retention of women in microscopy as the bootcamp continues over time. With broadened support and implementation of programs, we hope to be able to build a supportive network for women in microscopy. Due to the small cohort of participants, a quantitative analysis was neither statistically feasible nor could we guarantee participant confidentiality and anonymity. We hope that larger multi-site bootcamps like ours may allow for a quantitative and anonymized assessment of student learning, belonging and inclusion metrics, as well as long-term follow-ups on student success, retention, and career outcomes.

Enabling women's success in careers in academia and industry

An important aspect of this bootcamp was to highlight women scientists in both academia and industry who could share their scientific research, experiences, and serve as role models. Research indicates that a woman's networks with other women may play critical roles in their post-graduate career outcomes: for example, for women in professional careers, high-ranking women with a close inner circle of predominantly women was an important predictor in achieving executive positions, a requirement not seen for similarly qualified men[29]. Building these women-to-women networks in graduate school can allow for private exchange of information, including what labs or universities may be hiring, which positions offer concrete incentives like childcare, which groups or companies offer equal pay and advancement opportunities for women and men, and a candid take on department cultures that may help women in their career search.

Belonging for women in STEM includes empowerment to make productive and thoughtful choices about their career options after graduate school. Post PhD, approximately equal numbers of STEM graduates pursue postdoc and industry roles (~35% each), with some field-specific effects; more biologists go into postdoc positions, while more engineers go into industry roles with about equal partitioning across genders[30] (Fig. 2). However, the start-up phase of industry is notoriously gender-imbalanced with women accounting for just 9% of start-up founders[31]. While students are typically able to learn about academic responsibilities and benefits from on-campus mentors, visualizing a career or making connections with those in industry can be a significant challenge. While logistically challenging, in lieu of formal internships, we found that an ideal way for students to understand industry careers and network with

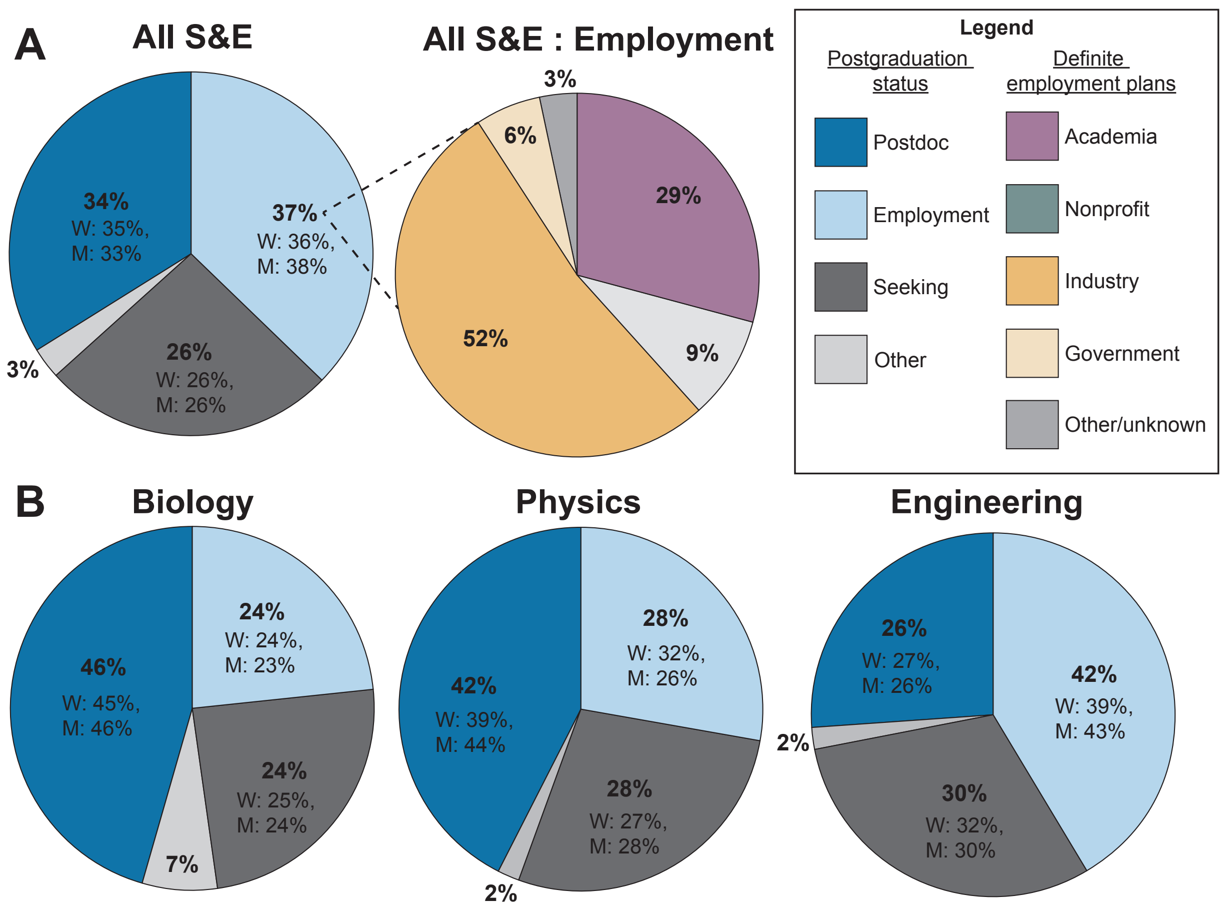

Figure 2. A) Post PhD positions for all Science and Engineering (S&E) fields. Employment sector further broken down by employer type. Trends are similar for men (M) and women (W). **B)** Postgraduation status by fields relevant for microscopy and optics careers. Data shown from NSF 2021 survey[11].

scientists is to visit companies on-site. We found many companies to be extremely receptive to hosting student groups and were eager to connect students with potential internship and career opportunities. Expanded hands-on education about industry careers not only addresses the growing number of PhDs entering those positions but may also offer tangible benefits particularly for women. Recent studies have found that the pay gap for women in academia is 1.5 times higher than that in industry roles and that gap widens over a woman's career; by mid-career, academic women are earning 7.2 percent less ($57,800 in 1995 dollars) than academic men ($62,300 annually in 1995 dollars)[32]. Some companies also offer benefits not currently standard in academic settings including IVF and egg freezing support, breast milk shipping and lactation support and on-site childcare[33]. Educating students about career choices at an early stage in the PhD addresses the diverse careers PhDs are seeking post-graduation, but may also specifically benefit women in building critical interpersonal career networks and may help inspire more women to launch their own companies as entrepreneurs.

Building intentional spaces of belonging for all

While this hands-on bootcamp, to our knowledge, was the first event of its kind for women in optics, there is precedent for this type of event: many other professional societies or organizations recognize the importance of specifically supporting women in male-dominated fields via conferences such as the annual APS Conference for Undergraduate Women in Physics (CUWiP) and the recent inaugural Women in Microscopy Conference held at Northwestern, as well as more broad identity-centered initiatives such as the National Diversity in STEM conference at SACNAS and the PAIR-UP Network for Black Imaging Scientists. Research shows that these types of events can have profound impacts on belonging. The APS has tracked indicators of belonging for participants of CUWiP and found significant increases in persistence in Physics degrees for all participants after attending a CUWiP conference, with the largest gains for women of color[34].

Furthermore, we would like to acknowledge the potential for bootcamps like this to also address the significant barriers that exist for transgender (trans) and nonbinary scientists, who often face a lack of belonging within scientific communities. Research shows that trans scientists consider leaving their workspaces at higher rates than cisgender survey respondents[35]. Moreover, trans and gender non-conforming (GNC) scientists face higher levels of bias, discrimination and violence in larger society; as mentioned in Fattaruso's call to action, the isolation and exclusion that trans and GNC scientists face has "grave consequences for [one's] mental health"[36]; thus, inclusion of trans and GNC scientists in diversity initiatives has material consequences for their quality of life. Ultimately, we would like to align ourselves with the growing movement of vocal advocacy for trans and gender non-conforming inclusion in STEM[37,38] and make clear our strategies for further inclusion in future bootcamp iterations. In our bootcamp flyers, we included language stating that "all genders and gender identities are welcome", however our bootcamp participants predominantly identified as cisgender women and we acknowledge that we could have gone further to specifically promote participation from genderqueer scientists. In future years we hope to increase trans and GNC participation through more inclusive advertising language, proactive recruiting of trans or non-binary speakers and industry leaders, and explicit participant recruiting through graduate student trans and GNC STEM affinity groups.

Many resources currently exist for students interested in learning microscopy and optics including bootcamp courses run at Janelia, Cold Spring Harbor, and Woods Hole. However, we argue that students benefit significantly from affinity-based learning opportunities to increase inclusion and belonging, particularly in interdisciplinary and majority-dominated spaces. While we focused on addressing sexism in the field of microscopy by creating a bootcamp to equip women in optics with introductory tools, networks, and experiences for success, we also anticipate that these strategies may enable other groups to create bootcamps that specifically encourage community learning among students holding other minoritized identities including racial and ethnic minority students or disabled students. For us, the success of our program largely depended on amassing a community of women microscopists in the Bay Area and virtual speakers from around the world who could serve as role models and participate in the bootcamp. In cases of small minoritized groups, gathering this critical mass can be challenging but particularly empowering for students who may have rarely encountered someone like themselves in their field. Additionally, academic society databases and social media platforms can connect microscopists from diverse backgrounds on a global scale[39].

Continued anti-racist and anti-sexist education and national policy changes will be important tools to improve the diversity of the faculty and industry workforce but should not encourage inaction. Creating a sense of belonging at the graduate level is critical for the diversification and success of students in STEM. Our synthesis of demographics within microscopy and the interdisciplinary fields it's built upon make clear an extreme gender gap in microscopy research, teaching, and industry. Microscopy as an interdisciplinary enterprise intersects fields with different demographics and cultures which can create specific challenges, and opportunities for, diversity initiatives. We found that specifically structuring a bootcamp course to center women and their careers was a successful tool to build skills, professional networks, and instill a sense of belonging for women in microscopy early in their PhD studies. We hope that our experience will fuel the development of tailored and effective programs which build intentional scientific communities where each person truly feels they belong.

Acknowledgements
We would like to thank the University of California Berkeley Biophysics Graduate Group and Office of Graduate Diversity for their support and for funding the Cal Women in Imaging + Industry Applications bootcamp. We thank bootcamp organizers, faculty and industry speakers including Liya Oster, Laura Gomez, Thomas Graham, Sam Lewis, Marla Feller, Ulrike Boehm, Gokul Upadhyayula and Teledyne Photometrics. We thank the companies who sponsored tours including 10X Genomics, Eikon Therapeutics, Zeiss, and Calico Life Sciences. Additionally, we would like to thank Xavier Darzacq, Robert Tjian, and Denzil Streete for encouragement and support in writing this manuscript.

References

1. Ding, W. W., Ohyama, A. & Agarwal, R. Trends in gender pay gaps of scientists and engineers in academia and industry. *Nat. Biotechnol.* **39**, 1019–1024 (2021).
2. Bendels, M. H. K., Müller, R., Brueggmann, D. & Groneberg, D. A. Gender disparities in high-quality research revealed by Nature Index journals. *PLOS ONE* **13**, e0189136 (2018).
3. Safdar, B. *et al.* Gender Disparity in Grants and Awards at the National Institute of Health. *Cureus* (2021) doi:10.7759/cureus.14644.
4. Jebsen, J. M., Nicoll Baines, K., Oliver, R. A. & Jayasinghe, I. Dismantling barriers faced by women in STEM. *Nat. Chem.* **14**, 1203–1206 (2022).
5. Holman, L., Stuart-Fox, D. & Hauser, C. E. The gender gap in science: How long until women are equally represented? *PLOS Biol.* **16**, e2004956 (2018).
6. Meet the women smashing gender stereotypes in science professions. *ABC News* (2022).
7. McGee, E. O. & Bentley, L. The Troubled Success of Black Women in STEM. *Cogn. Instr.* **35**, 265–289 (2017).
8. Calaza, K. C. *et al.* Facing Racism and Sexism in Science by Fighting Against Social Implicit Bias: A Latina and Black Woman's Perspective. *Front. Psychol.* **12**, (2021).
9. Staniscuaski, F. *et al.* Gender, Race and Parenthood Impact Academic Productivity During the COVID-19 Pandemic: From Survey to Action. *Front. Psychol.* **12**, (2021).
10. Staniscuaski, F. *et al.* Impact of COVID-19 on academic mothers. *Science* **368**, 724–724 (2020).
11. Viglione, G. Are women publishing less during the pandemic? Here's what the data say. *Nature* **581**, 365–366 (2020).
12. Myers, K. R. *et al.* Unequal effects of the COVID-19 pandemic on scientists. *Nat. Hum. Behav.* **4**, 880–883 (2020).
13. Andersen, J. P., Nielsen, M. W., Simone, N. L., Lewiss, R. E. & Jagsi, R. COVID-19 medical papers have fewer women first authors than expected. *eLife* **9**, e58807 (2020).
14. Zhou, E. *Graduate Enrollment and Degrees: 2011 to 2021*. www.ets.org/gre (2022).
15. Cal Answers. *HR Census* (2022).
16. Berkeley Biophysics Faculty.
17. Society of Photo-Optical Instrumentation Engineers (SPIE). *Gender Equity in the Optics and Photonics Workplace*. https://spie.org/about-spie/advocacy/women-in-optics/women-in-optics-survey?SSO=1 (2017).
18. Ledford, H. How to solve the world's biggest problems. *Nature* **525**, 308–311 (2015).
19. Van Noorden, R. Interdisciplinary research by the numbers. *Nature* **525**, 306–307 (2015).
20. Sun, Y., Livan, G., Ma, A. & Latora, V. Interdisciplinary researchers attain better long-term funding performance. *Commun. Phys. 2021 41* **4**, 1–7 (2021).
21. Kraus, M. W., Torrez, B. & Hollie, L. S. How narratives of racial progress create barriers to diversity, equity, and inclusion in organizations. *Curr. Opin. Psychol.* **43**, 108–113 (2022).
22. Top 10 Ways to Be a Male Advocate for Technical Women | National Center for Women & Information Technology. https://ncwit.org/resources/top-10-ways-to-be-a-male-advocate-for-technical-women/ (2021).

23. Gender equality: focus less on ‘fixing the women’ and more on engaging men. *LSE Business Review* https://blogs.lse.ac.uk/businessreview/2020/09/10/gender-equality-focus-less-on-fixing-the-women-and-more-on-engaging-men/ (2020).
24. O’Donnell, G. STEM Fields Need Male Allies to Advocate for Greater Gender Equity. *INSIGHT Into Diversity* https://www.insightintodiversity.com/stem-fields-need-male-allies-to-advocate-for-greater-gender-equity/ (2019).
25. Emerson, J. Colorblind Diversity Efforts Don’t Work. *Harvard Business Review* (2017).
26. Ong, M., Smith, J. M. & Ko, L. T. Counterspaces for women of color in STEM higher education: Marginal and central spaces for persistence and success. *J. Res. Sci. Teach.* **55**, 206–245 (2018).
27. Dashper, K. Challenging the gendered rhetoric of success? The limitations of women-only mentoring for tackling gender inequality in the workplace. *Gend. Work Organ.* **26**, 541–557 (2019).
28. Beck, M. *et al.* Critical feminist analysis of STEM mentoring programs: A meta-synthesis of the existing literature. *Gend. Work Organ.* **29**, 167–187 (2022).
29. Yang, Y., Chawla, N. V. & Uzzi, B. A network’s gender composition and communication pattern predict women’s leadership success. *Proc. Natl. Acad. Sci. U. S. A.* **116**, 2033–2038 (2019).
30. Foundation, N. S. *Doctorate Recipients from U.S. Universities: 2021*. NSF 23-300 https://ncses.nsf.gov/pubs/nsf23300/report (2022).
31. Sullivan, J. Female entrepreneurs have long been underrepresented in biotech. An MIT team decided to find out why – Endpoints News. *Endpoints News* (2021).
32. Flaherty, C. The Grass May Be Greener for Women in Industry. *Inside Higher Ed* (2021).
33. Gillett, R. These 15 Companies Are Helping Female Employees Have It All. *Inc. Business Insider* (2017).
34. Poffenberger, L. CUWiP Positively Impacts Women in Physics. *APS News* **29**, (2020).
35. Exploring the workplace for LGBT+ physical scientists. *Exploring the workplace for LGBT+ physical scientists | Institute of Physics* https://www.iop.org/about/publications/exploring-the-workplace-for-lgbtplus-physical-scientists.
36. Fattaruso, L. Show up for transgender scientists. *Nat. Rev. Earth Environ.* **3**, 355–356 (2022).
37. Glausiusz, J. ‘I was no longer pretending or hiding’: a trans scientist finds a lab to call home. *Nature* **589**, 322–322 (2021).
38. Aguilar, R. Breaking the binary by coming out as a trans scientist. *Nature* **591**, 334–335 (2021).
39. RMS | Equity in Microscopy Resource.