The California State University
PROGRAM FOR EDUCATION AND RESEARCH IN BIOTECHNOLOGY (CSUPERB)

BIO 2017 I-Corps™ Bio-Entrepreneurship Workshop Report

July 2017

The National Science Foundation (NSF) made an Inclusive Entrepreneurship grant to CSU I-Corps, a program of the California State University Program for Education and Research in Biotechnology (CSUPERB), to "increase participation and promote inclusion of underrepresented populations in the National Innovation Network." As a result, CSU I-Corps organized and hosted the three-day BIO 2017 I-Corps Bio-Entrepreneurship Workshop for a diverse group of early-career researchers during this year's Biotechnology Innovation Organization (BIO) International Conference in San Diego. BIO supported the workshop by covering participants' conference registrations. The founding, organizing committee included leaders of The American Society of Microbiology's ABRCMS program, Biocom Institute, California Life Sciences Institute, and the United Negro College Fund. Working for the first time together, the partnership team designed and offered a new workshop that we hope will become an integral part of future BIO International Conferences.

Workshop At-A-Glance

- CSU I-Corps, based at San Diego State University, designed and hosted the first BIO I-Corps Bio-Entrepreneurship Workshop, in San Diego June 19-21, 2017.
- The workshop was made possible by an Inclusive Entrepreneurship supplemental grant from the National Science Foundation (NSF) and sponsorship from the Biotechnology Innovation Organization (BIO).
- Leaders from the American Society of Microbiology's ABRCMS program, Biocom Institute, California Life Sciences Institute (CLSI), and the United Negro College Fund (UNCF) guided and designed the workshop.107 researchers from 53 universities nationwide applied to attend.
- 24 graduate students and faculty members from 20 universities learned how biotechnology research-based ideas might answer market needs or societal problems. Each team conducted an average of 25 learning interviews at BIO 2017.
- Based on the BIO I-Corps experience, 100% of participants reporting see themselves working on biotechnology commercialization teams in the future.

BIO 2017 I-Corps Workshop Design

Workshop participants brought a wide range of research-based experiences and disciplinary expertise to San Diego. Based on our experience teaching ideation to faculty researchers, our ABRCMS partnership, and San Diego's deep bench of biotechnology expertise in the infectious disease space, we organized the workshop as a "hackathon" around a theme - combating antimicrobial resistance.

To kick off the workshop, industry experts and mentors described unmet needs and high-level problems in the infectious disease field. CSU I-Corps teaching team members ran exercises throughout the workshop to teach ideation methods, interview tactics, and evidence-based entrepreneurship concepts. As a result teams developed problem-solution fit hypotheses and formulated value propositions. Like all I-Corps teams nationwide, workshop teams then "left the building" to test hypotheses and assumptions on the BIO 2017 exhibition floor. The workshop felt like a typical I-Corps course "with all the pressures and demands of the real world."

The workshop's stated learning objectives were to:

- Experience working in diverse teams to identify problems worth solving,
- Understand value proposition design,
- Apply evidence-based entrepreneurship concepts via customer discovery,
- Learn how to maximize efficiency in learning and networking in a conference setting, and
- Learn about life sciences commercialization.

In addition, we aimed to nucleate an ongoing bio-entrepreneurship community of interest and practice. Importantly, a roster of industry mentors rotated to work with teams throughout the workshop. We initiated a #bioentrepreneurship Slack channel so that workshop participants and mentors could share experiences and stay in communication after the workshop. During BIO 2017, we organized a meet-up at the California Pavilion for all I-Corps teams attending the conference.

We designed the workshop so it can re-purposed around any biotechnology theme or grand challenge. The CSU I-Corps teaching team will work with National Innovation Network partners in Boston and Philadelphia to organize and offer the BIO I-Corps workshop in coming years.

BIO I-Corps Workshop Schedule at a Glance

Sunday, June 18

Move-in Day at Cuicacalli Suites, San Diego State University

Monday, June 19

- Welcome, Introductions & Logistics
- Introduction to the Problem Space – Antibiotic Resistance
- Domain Experts Explain & Teams Form
- Teams Research Problems and Formulate Ideas to Test at BIO 2017
- Dinner together at SDSU Faculty Staff Club

Tuesday, June 20

- Welcome to Day Two – Getting Out of the Building
- Stoke: How to Start and End a Conversation at BIO 2017
- Evidence-based Entrepreneurship
- Interviewing and Networking at a Conference
- Final Lessons Learned Story Telling
- Mock Learning Interviews
- Trolley Ride to BIO 2017 & Meet Customer Discovery Mentors at California Pavilion, BIO 2017 Exhibition Floor, San Diego Convention Center
- Conduct Interviews on BIO 2017 Exhibit Floor (Part I)
- California Pavilion Reception and MeetUp, including I-Corps Welcome from Pete Pellerito (BIO)

Wednesday, June 21

- Meet Customer Discovery Mentors at BIO 2017
- Conduct Interviews at BIO 2017 (Part 2)
- Teaching Team Office Hours, California Pavilion
- Trolley Back to SDSU
- Lessons Learned Presentations
- Group Photo, Reflections & Next Steps

Below: Guillermo Gerona-Navarro (Brooklyn College of CUNY), Benem-Orom Davis (Meharry Medical College), Melanie Mendez (University of California, Merced), Marketta Kachemov (University of California, Irvine), and Ian Saunders (Morehouse School of Medicine) after Final Lessons Learned Presentation (June 21, 2017).

I-Corps at BIO 2017

We based workshop operations during BIO 2017 at the California Pavilion on the Exhibit Floor. I-Corps teaching team members, industry mentors and alumni networked at the Pavilion and provided advice to teams working on customer discovery. We thank the Pavilion organizers and sponsors, including Biocom Institute, California Life Sciences Institute (CLSI) and the San Diego Innovation Council, for sharing their space and hosting our "home base" at the conference.

Pete Pellerito, Senior Policy Advisor Federal/State Economic Development & Technology Transfer, served as our main point-of-contact at BIO. During the spring, he worked with us to make sure workshop participants were welcomed at BIO 2017. He made connections within BIO to provide complimentary exhibit registrations to workshop participants. Those cost savings made the workshop feasible from a budgetary perspective. But more importantly, the relationship between BIO, the state biotech industry associations (Biocom Institute and CLSI), and CSU I-Corps provides a solid foundation for future bio-entrepreneurship workshops and a model for our colleagues in Boston and Philadelphia in coming years.

During Tuesday's California Pavilion reception, Mr. Pellerito welcomed workshop participants, I-Corps teams, and I-Corps program officers from NSF and NIH to BIO 2017. Significantly, he explained to the crowd assembled that the BIO board of directors adopted a set of principles on Workforce Development, Diversity, and Inclusion at its latest meeting. BIO "committed itself to being at the forefront of efforts to develop a diverse and talented global workforce."

Liisa Bozinovic, Executive Director at Biocom Institute, interviewed Dr. Chinonye "Chi-Chi" Nnakwe, AAAS Science and Technology Fellow at NSF, and Victoria Caban-Figueroa, a workshop participant headed to grad school at Georgia Institute of Technology. Put "on the spot, on-camera," Ms. Caban-Figueroa did a wonderful job describing her workshop experience! The resulting 10-minute video (http://bit.ly/2h3ENar) explains the importance of access to opportunities like the BIO 2017 I-Corps workshop, diversity and inclusion in the biotechnology workforce, and private-public partnerships to promote inclusive entrepreneurship.

Top: CSU I-Corps teaching team members and mentors held office hours at BIO 2017 in the California Pavilion. **Middle:** Pete Pellerito (BIO) welcomes workshop participants and I-Corps teams to BIO 2017 at the California Pavilion Reception. **Bottom:** Liisa Bozinovic (Biocom Institute), Chi-Chi Nnakwe (AAAS Fellow), Victoria Caban-Figueroa (University of Puerto Rico – Mayaguez/ Georgia Institute of Technology) and Susan Baxter (CSU I-Corps/CSUPERB) at the BIO Buzz Center.

"Workforce Development, Diversity, & Inclusion at BIO."
Available at: https://www.bio.org/diversity

BIO 2017 I-Corps Workshop Participant Voices
(Answers to open text questions in the post-workshop survey)

"My a-ha moment came to me at the end of the workshop. I realized that with enough customer discovery I can develop or design a potential product that can be brought to market."

"My most memorable experience was learning how to identify problems that need to be solved, as opposed to trying to find solutions right off-the-bat."

"It was really difficult to switch to thinking about stating problems, not immediately proposing solutions during first planning stages. During customer discovery one assumption we had is that we could somehow bypass the regulatory guidelines, and only with multiple interviews it became obvious that our initial idea was not viable from a [regulatory] standpoint."

"I had this 'fairy tale' assumption that if you had what you thought was a great idea it [would] take only a couple of months to get it to the market and make money of it. I didn't realize the amount of work and steps people go through to get there."

"I assumed that [if our idea] would solve a problem, it would automatically sell. However, I realized that talking to potential customers was important for designing the product to not only solve a problem, but fit the needs/wants of the customer."

"Our team was an amazing source of ideas, help and support. We had open communication and spent a lot of time together outside the workshop. The personal chemistry between us definitely helped. Overall, I believe we were part really lucky and part put good effort into making sure everyone got to wear different hats, take lead on their turn, and listen to each other."

"The nature of the workshop did not leave any room for an awkward team dynamic. We left our respective research fields back home and brought in our expertise to the team instead. Even though our team had a diverse background, including a chemical engineer, a mechanical engineer, a cell biologist, and a molecular biologist, we fit in like puzzle pieces and contributed equally in different aspects of the workshop. Our interviews at BIO 2017 (thanks to mock interviews during the workshop) were always in a good flow. We understood when to step up and complete a task or step down and let a team member take the stage."

"[The industry mentors] affected everything! We could not have done this without them. We learned a lot from the presentations given before each task / step in the process of designed thinking but we applied those concepts with the help of our mentors. They kept us on track, helped us realize the merits and flaws in our plans, and held our team together like glue. Each mentor contributed in a different and a very helpful way. Our ideas, concepts, customer discovery, and our pivot were only possible because of the guidance of the mentors."

"The success of this workshop is having so many talent and smart people sharing their experiences and knowledge without hesitation. Every industry mentor brought something different, and [helped] us to see different 'insides' of the process."

"This has been a life changing experience for me. It has been a few days after the workshop but my mind is still there. This workshop has completely changed the way I look at the world now. I'm extremely thankful to all mentors and the I-Corps program."

"I really enjoyed the group of participants. The cultural, scientific and career status diversity among us, provided an excellent environment for the exchange of ideas and multiplicity of approaches to a single problem. I really learned ways to engage a group in problem solving that I will definitely incorporate in my classroom."

Lessons Learned. Alisha Coffey (University of North Carolina), Gabrielle Lopez (Miami University), Clara Isaza (Ponce Health Sciences University), Mery Vet George De la Rosa (University of Puerto Rico, Medical Sciences Campus), and Serj Danielian (UC Riverside) give their Final Lessons Learned presentation (June 21, 2017).

BIO 2017 I-Corps Participants Answer: What advice would you give to someone interested in participating in this workshop?

Top: BIO 2017 I-Corps participants, Michael Conward (Rensselaer Polytechnic Institute), Diana Bogorodskay (Rensselaer Polytechnic Institute), Debi Mukherjea (Southern Illinois University School of Medicine) and Ninad Kothari (University of California Riverside), celebrate teamwork after the workshop. **Middle:** Allyn Forsyth (Singlera Genomics, Inc.) talks to the workshop teams about unmet diagnostic needs. **Bottom:** The BIO 2017 I-Corps workshop participants and teaching team members at the end of Day One (still smiling!).

"Be prepared to an intense 3-day workshop that will change your life."

"I would advise reading as you can on [I-Corps] before you arrive, although nothing is going to completely prepare you for what you are about to encounter over the next 3 days…"

"You should do it without hesitation. It will change your life."

"Come in with an open mind and get ready to learn!"

"Be ready to work through frustrations, have an open mind, and network as much as possible!"

"Rest well beforehand, go out with group after sessions, make friends and keep those friendships going. Definitely bring business cards! Go all in for the workshop but use the conference and the network you build for your personal career (attend booths of potential employers, career fairs etc.). All of the workshop skills are transferable to your own academic and professional life."

"Be prepared for the most intense but rewarding days of learning and new experiences."

"Be prepared to work long hours and for a lot of information"

"Have an open mind and be ready to learn. Since this is a short workshop, take advantage of the time to ask any and all of the questions that you have."

"To be ready for a highly-demanding program. Before the workshop, take time to read the material and watch the videos provided at the VentureWell NIN page. It was really helpful."

"Get a good night's sleep.

"Success comes from failure. Be prepared to work hard."

"Just to go to the workshop with a open mind and understand that it's a great learning exercise."

"It's a good workshop for learning about science and product commercialization."

"Buckle up, buttercup."

2017 (Inaugural) Workshop Participants:

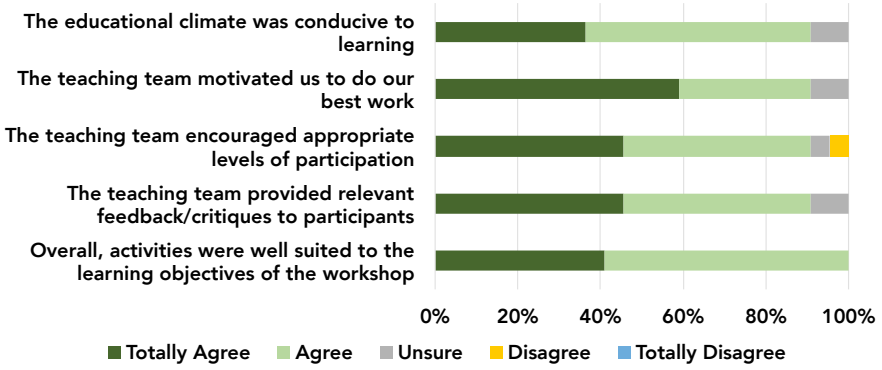
Marina Ascunce (University of Florida), Diana Bogorodskaya (Rensselaer Polytechnic Institute), Victoria Caban-Figueroa (Georgia Institute of Technology), Rocio Cardona (University of Puerto Rico, Bayamon), Patrick Carriere (Morehouse School of Medicine), Alisha Coffey (University of North Carolina), Michael Conward (Rensselaer Polytechnic Institute), Serj Danielian (UC Riverside), Benem-Orom Davids (Meharry Medical College), Jason Dragoni-Rosado (Interamerican University of Puerto Rico), Ronise Evans (Xavier University of Louisiana), Angel Flores (University of Georgia), Mery Vet George De la Rosa (University of Puerto Rico, Medical Sciences Campus), Guillermo Gerona-Navarro (Brooklyn College of CUNY), Clara Isaza (Ponce Health Sciences University), Marketta Kachemov (University of California, Irvine), Ninad Kothari (University of California, Riverside), Gabrielle Lopez (Miami University), Ivonne Maldonado (University of Turabo), Melanie Mendez (UC Merced), Debashree Mukherjea (SIU School of Medicine), Ian Saunders (Morehouse School of Medicine), Donte Stevens (University of North Carolina), Bianca Valdes Fernandez (University of Puerto Rico, Rio Piedras)

BIO 2017 I-Corps Workshop Expenditures

Lodging (in SDSU Dorms)	$5,838
Meals (hosted breakfasts, lunches and one dinner)	$4,361
Travel (including per diem for non-hosted meals)	$17,654
Meeting Space (at Aztec Student Union, SDSU)	$1,305
Parking/Trolley Fares	$394
Indirect Costs	$339
Complimentary Registrations	$4000
Total (direct, indirect, in-kind)	**$33,891**

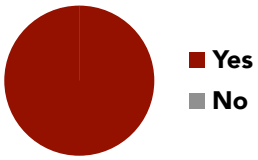
The BIO 2017 I-Corps workshop was staffed by CSUPERB program office staff, designed by the CSU I-Corps teaching team, administered by the organizing partners' committee, and mentored by industry professionals and National Innovation Network instructors. Their significant contributions of time during winter 2016 and spring 2017 are not included in the financial reporting here.

Major cost savings were realized by providing lodging in the SDSU dorms and meeting space on campus. It is unlikely future workshop organizers will be able to secure such affordable lodging conveniently located near a convention center. Our workshop budget estimate, based on San Diego hotel room rates and meeting spaces, was ~ $60,000.

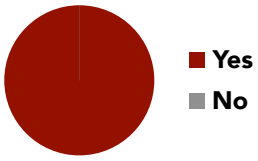


Post-Workshop Participant Feedback

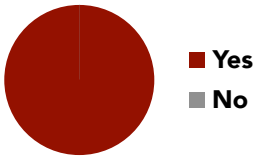
Did you grow your personal biotechnology industry network during the BIO I-Corps workshop? For example, did you meet someone new you might feel comfortable asking for advice in the future or someone you added to your LinkedIn connections?



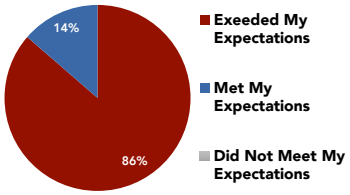
Based on your BIO I-Corps experience, can you see yourself working on biotechnology commercialization teams in the future?



Looking forward, do you think you'll attend another Biotechnology International Conference like BIO 2017?



Overall, how well did the BIO 2017 I-Corps Bio-Entrepreneurship Workshop meet your expectations?



BIO 2017 I-Corps™ Bio-Entrepreneurship Workshop Leadership

CSU I-Corps Teaching Team

Susan M. Baxter,
PI, CSU I-Corps
CSUPERB
(http://www.calstate.edu/csuperb)

Alex DeNoble
Lavin Entrepreneurship Center,
San Diego State University

Stanley Maloy
Dean, College of Sciences,
San Diego State University

Tommy Martindale
Office of Technology Transfer,
San Diego State University

Cathy Pucher
Zahn Innovation Platform,
San Diego State University

Organizing Partners

Avery August
Cornell University & ABRCMS

Liisa Bozinovic
Biocom Institute

Lori Lindburg
California Life Sciences Institute

Chad Womack
United Negro College Fund

Facilitators & Mentors

Stephen Betz
Crinetics Pharmaceuticals

Stephen M. Ferguson
NIH Office of Technology Transfer

Allyn Forsyth
Singlera Genomics, Inc.

Martin S. Kleckner
TriTech & North San Diego County SBDCs

Jeff Locke
Cidara Therapeutics

Brandy Nagel
Georgia Institute of Technology

Chinonye "Chi-Chi" Nnakwe
AAAS Science and Technology Fellow at NSF

Marc Sedam
University of New Hampshire

David Spellmeyer
Interlaken Associates

Bradford A. Young
BAY Strategic Consulting

Background and History

The *California Talent Integration* (2016) report provides context for the Bio-Entrepreneurship Workshop: "Life science industry executives in California lament the weak pipeline of future talent from groups that are already underrepresented (i.e., African American, Hispanic, and female) in STEM (science, technology, engineering and math) fields. Many recognize that career paths or pathway roadblocks are set at a very early age and that the industry needs to do more to engage these underrepresented populations…"

Given there is no shortage of diverse talent across the nation, the CSU I-Corps Teaching Team hypothesizes that many academic researchers remain blind to the intricacies of biotechnology product development and, as a result, might view commercialization activities and biotech careers as risky. We also observe that life sciences researchers need help in ideation or design thinking. As Walter Valdivia wrote, "The imagination needed is to figure out how to improve our harvesting methods, how to deepen our reach into science, how to rethink research findings as solutions to practical problems..." Bio-entrepreneurship programs can play a large role in unmasking the process, behaviors and skills needed to advance research ideas toward commercialization.

Conversely, industry employers and venture finance firms may not have opportunities to work with or to deepen their reach into the diverse, far-flung universities educating talented, underrepresented students. Entrepreneurship programs like I-Corps offer a way to close these gaps in awareness, familiarity and knowledge, and bring together university-based researchers, industry professionals and employers.

In 2016 Dr. Chad Womack, National Director of the United Negro College Fund (UNCF) STEM Initiatives, worked with California Life Sciences Institute (CLSI) President and CEO Lori Lindburg to organize a National Biotechnology and Pharmaceutical Association - UNCF - Merck Bio-entrepreneurship & Innovation Symposium. As a result Susan Baxter, CSU I-Corps PI, participated as a panelist at that event in San Francisco.

Afterwards Drs. Womack and Baxter discussed connecting the UNCF community, its affiliated historically black colleges and universities, and the NSF's I-Corps National Innovation Network. We wanted to bring together a wider set of partners to pilot a Bio-Entrepreneurship Workshop for underrepresented academic researchers at BIO 2017 in San Diego.

The organizing committee's goal is to make this workshop an integral part of BIO conventions going forward. In tandem the I-Corps National Innovation Network gains a beach-head at the largest gathering of biotechnology commercialization professionals in the world.

Talent Integration: California Workforce Trends in the Life Science Industry (2016). Available at: http://califesciencework forcetrends.org/2016-talent-report.html

Walter Valdivia (2013), University Start-Ups: Critical for Improving Technology Transfer, Brookings Institute. Available at: https://www.brookings.edu/research/university-start-ups-critical-for-improvingtechnology-transfer/

Participant Demographics

Gender Representation:

Applications: 54% Female, 46% Male
Acceptances: 52% Female, 48% Male

Career Stage:

Applications		Participants
12%	Faculty/Staff Scientist	28%
13%	Postdoctoral Fellow	0%
63%	Graduate Student	72%
14%	Undergraduate Student	0%

Campus Home:

Applications		Participants
42%	Public Research University	40%
12%	Private Research University	12%
34%	Regional Comprehensive	34%
1%	Private, Primarily Undergraduate Institution	4%
11%	Medical School	16%

Participant Ethnicity:

Asian	8%
Black or African American	25%
Hispanic or Latina/o	46%
Two or More Races	8%
White or Caucasian	13%

Details: Outreach & Selection Process

We opened the workshop to early-career life science researchers from groups underrepresented in biotechnology degree programs and research organizations. Assistant professors, postdoctoral fellows, graduate students, and undergraduates were eligible to participate. To guarantee access, the NSF grant covered participants' travel to and from San Diego, as well as lodging and meals at San Diego State University during the workshop.

A call for participants was issued through the organizing partners' networks; the call was open only 8 weeks, March 1 – May 1, 2017. We also received outreach help from the Association of University Technology Managers (AUTM) and the National Institutes of Health (NIGMS) Division of Training, Workforce Development and Diversity.

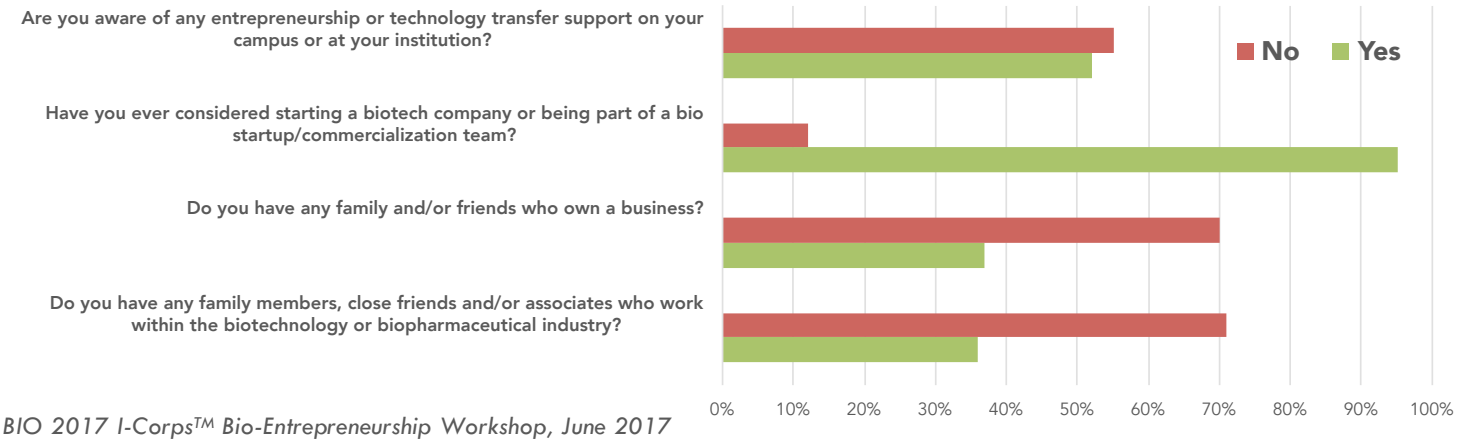
We received 107 applications from curious researchers and nascent academic entrepreneurs from 53 universities nationwide. Applicants did not have previous commercialization experience, a developed venture concept, or any intellectual property in hand. This workshop would be less useful to researchers who were already moving down a commercialization pathway (filed provisional patent application, licensed IP, received SBIR funding, etc.); we suggested those applicants attend courses offered by I-Corps Sites and Nodes nationwide instead.

The selection committee was drawn from the CSU I-Corps Teaching Team and the organizing partner organizations. The overarching selection criterion was "who would gain the most from the experience?" We reviewed applications with four criteria: 1) a complete application received by the deadline, 2) the applicant's research background, 3) a lack of previous technology transfer training, and 4) a stated desire to learn about biotechnology commercialization. We required letters of reference for undergraduate applicants only.

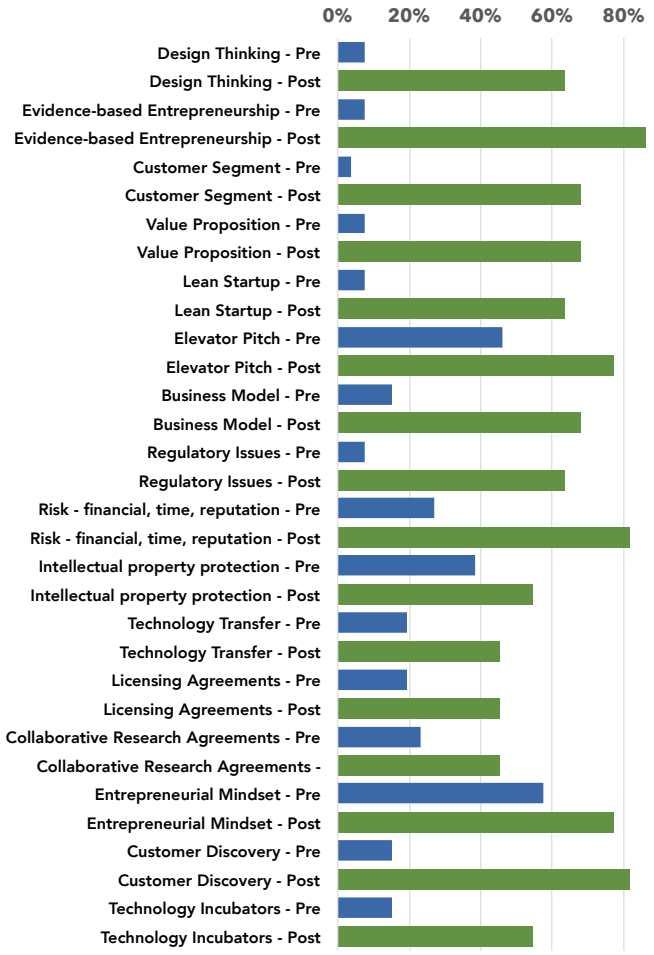
We selected 25 applicants from 20 universities. Four awardees decided not to attend (postdocs and undergraduates). We pulled from a ranked waiting list to fill the workshop; in the end only graduate students and assistant professors attended. 24 participants attended the workshop; one accepted graduate student cancelled at the last minute and is not counted.

We were surprised to see so few applications from postdoctoral fellows and primarily undergraduate institutions. Going forward we recommend opening the application process earlier and longer, while also involving additional national organizations, such as the National Postdoctoral Association, SACNAS, or the Council for Undergraduate Research.

BIO 2017 I-Corps Workshop: Applicant Pool



The National Innovation Network's I-Corps courses are organized around a core set of concepts. BIO 2017 I-Corps workshop participants indicated their level of familiarity with each concept before (blue bars) and after (green bars) the workshop. Reported here are percentage of workshop participants who responded they had HIGH familiarity (Can explain it in depth but not sure how to apply it) or VERY HIGH familiarity (Can explain it in depth and can apply it) with I-Corps concepts.



Details: Learning Outcomes

Before and after the workshop, we surveyed participants to gauge their learning and report on their activities. 26 people completed the pre-survey; 22 (92% participants) completed the post-survey. 100% of the participants responding "totally agreed" or "agreed" the workshop activities were suited to the learning objectives. 100% said the workshop "met" or "exceeded" expectations. 100% agreed that BIO 2017 was a good venue for learning; 100% said they grew their personal professional network.

All workshop teams completed an average of 25 learning interviews at BIO 2017. Compared with self-reported learning and gains data from CSU I-Corps Short Course participants, the workshop participants gained confidence and learned concepts to similar levels.

This was a surprise to the teaching team, but reflects the impact of embedded mentors and the intense, immersive experiences at BIO 2017. The lessons learned presentations teams gave on the last day of the workshop mirror this self-reported data. Teaching team members and mentors present were astounded at the teams' gain in familiarity with biotechnology commercialization concepts.

Reacting to these outcomes at the end of the workshop, **Dr. Nwakwe announced that the BIO 2017 I-Corps workshop participants were now eligible for the NSF's national Teams Program.** This means any of the workshop participants can apply for a $50,000 NSF grant to advance research-based ideas toward the market. Over the next 3 years, we will follow up with workshop participants to find out whether any of them take advantage of this opportunity, or make other moves toward technology transfer activities.

We asked participants to consider possible benefits or learning they may have gained from the BIO 2017 I-Corps workshop experience. Reported in this chart are percentages of participants who reported "Large Gains" or "Very Large Gains" in answer to each prompt.