



Yale College

Science & Quantitative Reasoning

SCIENCE
TECHNOLOGY
AND
RESEARCH
SCHOLARS

REACH FOR THE STARS

The Science, Technology and Research Scholars **(STARS)** Program is designed to support underrepresented and economically disadvantaged students in STEM and provide them with opportunities for experiential research.

Astrophotos by Sandy Chang

PROGRAMS

STARS I ACADEMIC YEAR

- Network for first-year STEM majors.
- Upper-level students serve as peer tutors and mentors.
- One-on-one advising, study groups, informational sessions, and professional development.

STARS SUMMER RESEARCH PROGRAM

- An on-campus summer program for first-year students to conduct research with a Yale faculty member.
- Enrollment in Scientific Research course for one WR credit.
- Present research findings to peers and campus community at a symposium.
- Evening and weekend activities to facilitate group interaction.

STARS FACULTY-STUDENT DINNER SERIES

- Monthly faculty dinner with STARS sophomores.
- Women/URM faculty discuss their careers/ scientific journeys and current lab projects.
- Students often choose participating professors to become mentors.

STARS II

- Junior and senior year academic stipend support for lab research.
- Summer stipend support.
- Workshops designed to prepare scholars for scientific conferences.
- Symposium to showcase research projects.

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When I arrived at Yale in 1984 as a low-income student, I was eager to work in a lab to further my interests in molecular biology. I was involved in many science fair projects as a high school student and working with a Yale professor was the next logical step. At that time however, Yale did not offer any centralized guidance to undergraduate researchers or any financial support. My first paid research experience occurred at another institution, and only after I volunteered in a Yale lab for two years did my faculty mentor offer to pay me a small stipend the summer after junior year. I would really have benefited from participating in a program like STARS.

The STARS I program, founded in 1995 by Drs. Kimberly Goff-Crews, Kurt Zilm, Kenneth Nelson and others, began as a STEM tutoring program to support first and second-year women and underrepresented minorities (URM). STARS I has since evolved to use senior peer mentors to facilitate the successful integration of URM students into Yale STEM classes. The STARS Summer Research Program started in 1996, in response to reports documenting that participating in experiential research opportunities is the single most important experience for undergraduates considering a scientific career. STARS Summer allowed rising sophomores to work side-by-side with Yale faculty mentors. Students tell me that the bonds they forged with their mentors and peers in this program last to this day.

STARS II began in the fall of 1998 and is still the only program at Yale where juniors and seniors are paid to do research during their academic years. Professional development workshops prepare these outstanding junior scientists to gain entry into prestigious medical and graduate programs. New programs added in recent years further improve the STARS experience. These include a monthly dinner series for STARS sophomores to meet with URM faculty and a year-long Perspectives in Biological Research (PBR) course where STARS I students learn how to read and present primary scientific literature. Students who participate in PBR are also guaranteed summer research funding to work in Yale research labs. We anticipate that participation in PBR will provide students the necessary preparation to succeed in any STEM courses at Yale.

STARS programs have been extraordinarily successful in promoting persistence in STEM majors at Yale, and most STARS students continue to pursue a scientific discipline after graduation. A study by the Yale Office of Institutional Research revealed that students participating in STARS programs were significantly more likely than non-STARS students to persist in STEM majors. These encouraging results were highlighted by the 2018 Report of the University Science and Strategy Committee, which states in part, "data collected over two decades clearly demonstrate that STARS improves the retention and performance of its participants."

As we celebrate the 25th anniversary of this extraordinary program in April 2021, STARS programs must evolve in order to continue to promote a more diverse, equitable and inclusive STEM environment for our URM students. In particular, we need to increase the number of students in PBR, STARS Summer and STARS II programs to keep pace with the increased number of URM students admitted annually to Yale. Additionally, we need to continue fostering relationships between Yale URM faculty mentors and STARS alumni with STARS undergraduates. With these changes, I am confident that we will be celebrating the success of the STARS programs 25 years from now.

Sandy Chang, MD/PhD
Yale College '88
Associate Dean of Science and Quantitative Reasoning Education
Director, STARS Programs
Professor of Laboratory Medicine, Pathology and MBB



I was fortunate to be one of the founders of the Science, Technology and Research Scholars (STARS) program. In the beginning, we - Drs. Kimberly Goff-Crews, Shannon Salinas, and myself, did not know how such a program should look like.

We inquired with other universities (MIT, University of Georgia, and University of California, Berkeley) about programs they had established to help their incoming URM students. None of them seemed to fit what we wanted at Yale, so we selected a few of their ideas and added our own. Dr. Iona Black and I did the teaching and the symposium practices and Dr. Kailas Purushothaman joined us to shore up physical sciences teaching. After Dr. Black left Yale, Dr. Maria Moreno became the principal instructor in the STARS Summer program.

The past 26 years of working with STARS students has been extremely rewarding. It takes a lot of time and effort to organize the summer program, the lectures, the study breaks, the trips, the evening study sessions, and the presentations both at Yale and at national science meetings. It is now very clear that all of these efforts paid off spectacularly. I have watched students who started out struggling in their courses finish their Yale careers tutoring those same courses to younger STARS students. I have witnessed students who were afraid of speaking to any group about their research or accomplishments make presentations that wowed faculty members of the National Academy of Sciences. I have watched students, who questioned whether they belonged at Yale and if they might even not graduate, complete their undergrad educations, go on to medical school, law school, or graduate school and finish those career steps also. I feel nothing but proud of these students. You have made the investment so worth it.

Good luck in the rest of your life's accomplishments.

Kenneth Nelson, PhD
Senior Lecturer and Research Scientist
Dept. of Molecular, Cellular and Developmental Biology

★ STARS SUMMER FELLOWS



★ STARS I

STARS I peer mentors facilitate successful integration of underprepared students into Yale STEM classes. Mentors teach strategies in classes and plan out a four-year course schedule. These activities are designed to instill student self-confidence. The program also includes faculty-led workshops and social events designed to support the development of a community of first-year scholars interested in pursuing STEM majors at Yale.



"STARS Summer connected me with others who shared my love for science."

★ Stephanie Horsfall '21 MCDB major

Coming from a public high school in Oklahoma, I didn't have a lot of opportunities to find out if I wanted to pursue a career in science. The STARS Summer Program not only gave me the ability to engage in scientific research and communications, but also connected me with other students who shared my love for science. Being a mentor for the STARS I program allows me to guide first year students from a similar background to mine about the potential struggles of Yale and how to navigate through them in order to make the best out of their four years here.

Stephanie's project: Investigating the Role of p53 in Gene Repression



"The STARS I program has really helped me reaffirm my interest in STEM."

★ Charnice Hoegnifioh '24

There were several occasions where I struggled with the reality of attending Yale. At the STARS I Imposter Syndrome workshop, it was encouraging to hear current STARS mentors' strategies for overcoming their personal doubts. The support I felt from the STARS I community helped me to acknowledge and accept my personal accomplishments, as well as feel like I truly do belong at Yale. The STARS I program and the PBR course has really helped me reaffirm my interests in STEM.

STARS I BY THE NUMBERS

107 STUDENTS in 2020-2021 | 3:2 FEMALE: MALE

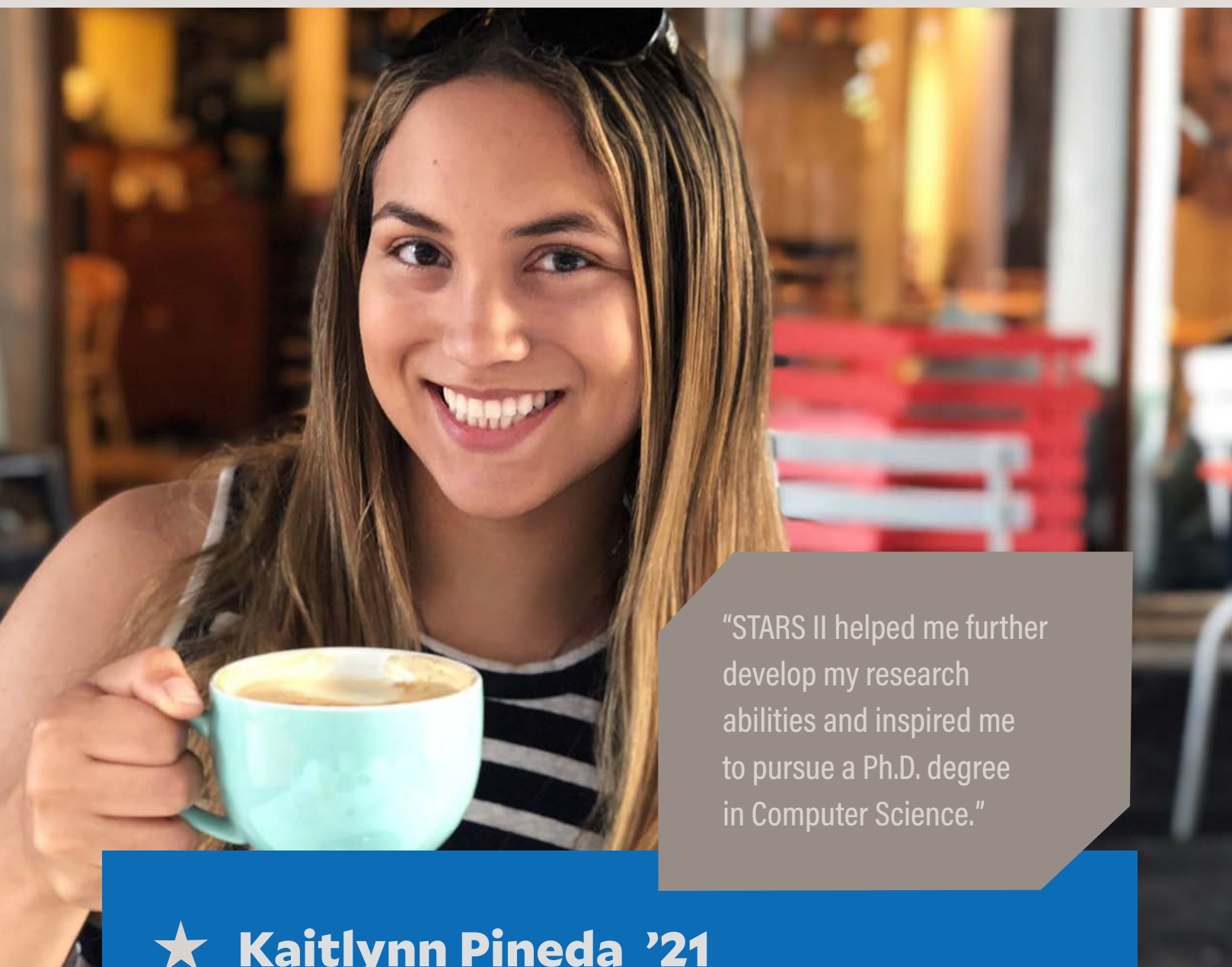
UNDER REPRESENTED MINORITIES (URM) 48% | 52% FIRST GENERATION | 100% FINANCIAL AID

13 PEER MENTORS | 1:8 MENTOR TO STUDENT RATIO

Beginning in 2020, STARS I students can take a class called **Perspectives in Biological Research (PBR)**, a year-long course that provides students with the scientific skills necessary for success in advanced STEM classes. These skills include the ability to understand primary scientific research papers and distill the contents for effective scientific presentations. In addition, students learn how to write research fellowships. Students successfully completing PBR are guaranteed funding to do summer research with a Yale faculty mentor.

★ STARS SUMMER

STARS Summer is a nine-week long program where rising sophomores work as full-time junior scientists directly under the supervision of Yale faculty. Students take a class where they learn scientific presentation skills and actively participate in weekly journal club sessions to discuss primary research articles. At the conclusion of the program, students submit their research results in a publishable format and present their research findings in a two-day symposium.



"STARS II helped me further develop my research abilities and inspired me to pursue a Ph.D. degree in Computer Science."

★ Kaitlynn Pineda '21

EE and CS majors

At Yale, I discovered that scientific research exists in computer science and engineering. My first research experience began during STARS Summer in the Social Robotics Lab, where I designed human-subject experiments with robots and developed scientific communication skills. This experience helped me discover a passion for computer science research. STARS II helped me further develop my research abilities and inspired me to pursue a Ph.D. degree in Computer Science. I am immensely grateful for my experiences in the STARS programs that have prepared me for future research experiences and introduced me to a diverse community of aspiring researchers.

Kaitlynn's project: Trusting Robots: Examining the Influence of Robotic Personality and Embodiment on Human Trust



"Thanks to the STARS programs, my passion for cancer research has never been more intense."

★ Jaída Morgan '23

STARS programs influenced my passion for science by giving me a sense of courage that I previously lacked. As a Black woman in STEM, I second-guessed my ability to pursue cancer research upon starting my Yale career. My impostor syndrome provoked a loss of interest in science because I lost faith in myself. However, being in STARS I restored that faith and passion. I got my first glimpse into telomere biology research from my lab mentor, better learned how to read research papers and fueled my passion for scientific research with like-minded and supportive peers. Presenting my progress at the STARS Summer Symposium and feeling confident about my work elevated my confidence. Thanks to the STARS programs, my passion for cancer research has never been more intense.

Jaída's project: Determining DNA Damage Response and DNA Repair Pathway at Dysfunctional Telomeres

STARS SUMMER BY THE NUMBERS

30
STUDENTS

57%
FEMALE

40%
URM

Class: SCIE S101, Scientific Research - Process and Presentation (1 writing credit).

Program costs; on-campus housing, board, course tuition, and stipend are covered.

Students present their research at a symposium on campus to peers and faculty.

Community building activities organized by STARS summer counselors.

★ STARS II

STARS II provides juniors and seniors stipends to do research during their academic year with Yale faculty mentors. Students attend monthly workshops that enhance various scientific skills and help them prepare applications to graduate and medical schools. STARS II students present their research at the annual STARS II symposium and also receive funding support to present their research at national and international scientific conferences.



"I began my undergraduate research through STARS Summer. Without the stipend and housing, I would not have been able to begin working in a lab that summer."

★ Carli Roush '22

EEB major

As a woman in STEM from a low-income background, I started college with weak STEM preparation. As a first-year, I was able to engage with fellow underrepresented students in STEM and received valuable mentoring through the STARS I program. I began my undergraduate research through STARS Summer. Without the stipend and housing, I would not have been able to begin working in a lab that summer. Participating in STARS II allows me to continue conducting research without fear of financial burden while developing the community I have found. The STARS programs have given me access to many professional opportunities I would not otherwise have had.

Carli's project: Exploration of the Properties of Phage U136B-Resistant Bacteria containing Unknown Mutations



"Through the STARS Summer and STARS II programs, I pursued research in a strong community of students from similar backgrounds."

★ Justin Cheong '21

MCDB major

As a first-generation college student, I did not have many opportunities to explore scientific research before college. The STARS I mentors and workshops helped me choose science courses for my major, find a research lab, write research proposals, and prepare for medical school applications. Through the STARS Summer and STARS II programs, I pursued research in a strong community of students from similar backgrounds. I am thankful for the social, academic, and professional support of the STARS community, which has been invaluable to my growth as a scientist.

Justin's project: Biophysical Characterization of Mutant and Wild Type Biofilm Surface Layer Protein A (BslA) at the Air-Water Interface.

STARS II BY THE NUMBERS

JUNIORS
+ SENIORS

27

STIPEND

to perform academic year and summer term research.

WORKSHOPS

to promote career development and interactions with STARS alumni.

Students have presented their research projects at national conferences such as the Annual Biomedical Research Conference for Minority Students (ABRCMS) and Society for Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS).

★ JASQUELIN PEÑA

"I had the opportunity to join a cardiology lab, led by Dr. Albert Sinusas at the Yale Medical School."

Yale '01 BS Chemical Engineering, UC Berkeley '04 & '09 MS & PhD Environmental Engineering

“ The STARS program allowed me to explore sub-fields of engineering that I was attracted to as an undergraduate and provided a number of transformative experiences. Early on, I thought I would follow a career in biomedical engineering. I had the opportunity to join a cardiology lab, led by Dr. Albert Sinusas at the Yale Medical school. Dr. Sinusas' lab gave me a first glimpse into basic research and team science and how these fuel discoveries. Later, I changed fields and labs. I worked in Dr. Gary Haller's group on the reactivity of chromium-substituted molecular sieves. That introduction to redox-sensitive elements, X-ray absorption spectroscopy and experimental chemical research formed the basis for topics and methods I would pursue later (and today!) as a professor of environmental engineering. While cutting tubing for a gas chromatograph, one of the postdocs I worked with encouraged me to “leave room for change”. Wise words. ”

"My experience as a member of the STARS program showed me the importance of having a community in science."

Yale '19 BS Physics (Int.), Carnegie Mellon University, PhD Program in Physics

“ For most of my life, I was usually one of the only one or two African Americans in my upper-level STEM courses. Because of this cultural isolation, I never really had the chance to experience the benefits of interacting with a community that looked like me. The STARS program gave me the opportunity to reach out and connect with other African American science students at Yale. We talked about how we each usually were the only African American in our courses and how we could only think of one or two African American professors in our entire departments. My experience as a member of the STARS program showed me the importance of having a community in science. For that reason, I now desire to become a college professor. I want to both inspire and mentor future African Americans so that I can work to grow the African American community in STEM. ”

★ BYRON DANIEL

“STARS opened my eyes to see STEM not only as a lucrative career, but more importantly as a means of doing good for my People.”

Yale '15 BS Mechanical Engineering, Univ of Virginia Darden School of Business '20 MBA

“ The Tohono O'odham Nation has the lowest income per capita of any US Native American Reservation and the highest rate of diabetes in the world, with 50% of members being diagnosed with adult on-set diabetes. As a member of the T.O. Nation, I saw Yale and engineering as a way to meld my passion for science and math with my need to provide socioeconomic stability for myself and my family. STARS enabled me to match with the Schroer's Materials Science lab, where a fellow first-gen, rural-upbringing female PhD candidate quickly took me under her wing. After a summer of STARS research developing novel metallic glass alloys alongside her, I was hooked. The remainder of my Yale career, that same PhD farm girl and I pursued patents for our non-corrosive glucose sensors for diabetes patients. In the midst of preparing for my STARS symposium, I realized that my glucose sensors could have immediate positive impact on the health of the Tohono O'odham Nation. STARS opened my eyes to see STEM not only as a lucrative career, but more importantly as a means of doing good for my People. After spending several years as an engineer and completing my MBA at UVA's Darden School of Business, that passion I discovered through STARS remained, and I find myself managing multimillion-dollar DaVita clinics that provide dialysis to Native American diabetes patients all over the country. Without STARS, I certainly would not have had the drive to pursue a career that both sustains me financially and impacts the livelihood of Native Americans on a daily basis. ”



“To this day, 20 years after graduation, I continue to believe that STARS was the most important part of my Yale education.”

Yale '01 BS Molecular Biophysics & Biochemistry, Princeton Univ '07 PhD Molecular Biology

“ STARS was instrumental in my pursuit of science. Being a STARS Summer Fellow helped me get into my first lab and get the hands-on experience I needed to apply to graduate schools. The study groups during the year as a STARS I student were crucial to giving me the academic and social support I needed to be successful. The opportunities to present my research allowed me to discuss my work in interviews and symposia when I got into graduate school. The funding from STARS made it possible for me to do lab research and still fulfill my work study requirements. Without the financial, social, and academic support STARS provided, I am not certain I would have succeeded as a Molecular Biophysics and Biochemistry student. To this day, 20 years after graduation, I continue to believe that STARS was the most important part of my Yale education. ”

★ ELIAS QUIJANO

"Today, I continue to be involved with STARS I students, working with Dean Sandy Chang to support the next generation of URM/FGLI scientists."

**Yale '08 BS Biomedical Engineering,
Yale School of Medicine '23 MD/PhD**

“When I first arrived at Yale my freshman year, I had no idea what I had gotten myself into. As a first-generation college student, I had no familial insights to rely on as I began to navigate the academic rigors of Yale. I knew I wanted to become a scientist, but I did not know how to turn that dream into a reality. My early path towards becoming a biomedical engineer was extremely difficult, resulting in several near catastrophic academic failures. My sophomore year of college, however, Dean Rosalinda Garcia introduced me to STARS, where I was given an incredible opportunity to pursue science with the academic and financial support I needed. It was through STARS summer that I met Dr. Maria Moreno, Dr. Ken Nelson, and Dr. Kailas Purushothaman – faculty mentors that till this day continue to support me. I continued my research in STARS II, and this program cemented my interest in pursuing a career in academia. I am currently a MD/PhD student at Yale Medical School, which would have never happened without participation in the STARS programs. Today, I continue to be involved with STARS I students, working with Dean Sandy Chang to support the next generation of URM/FGLI scientists.”

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★ NATASHA ARCHER

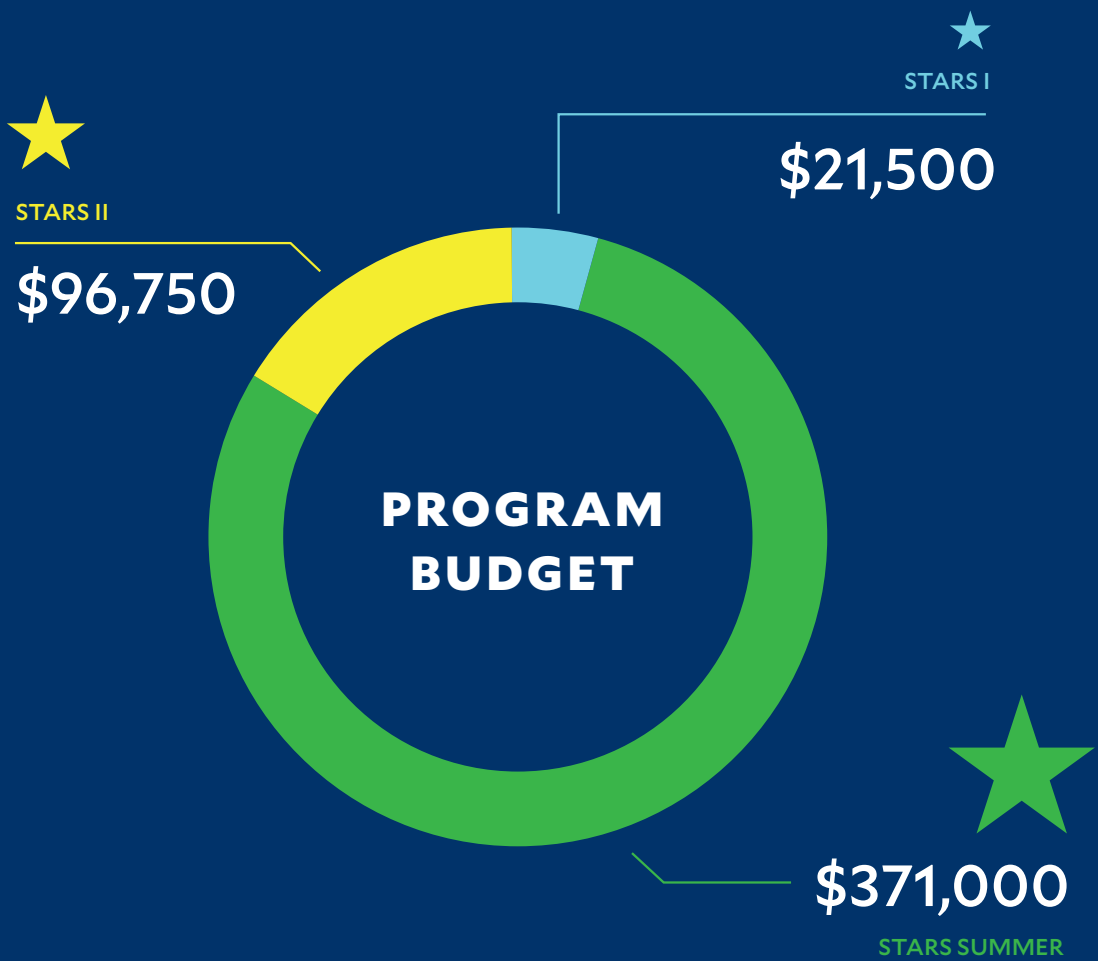
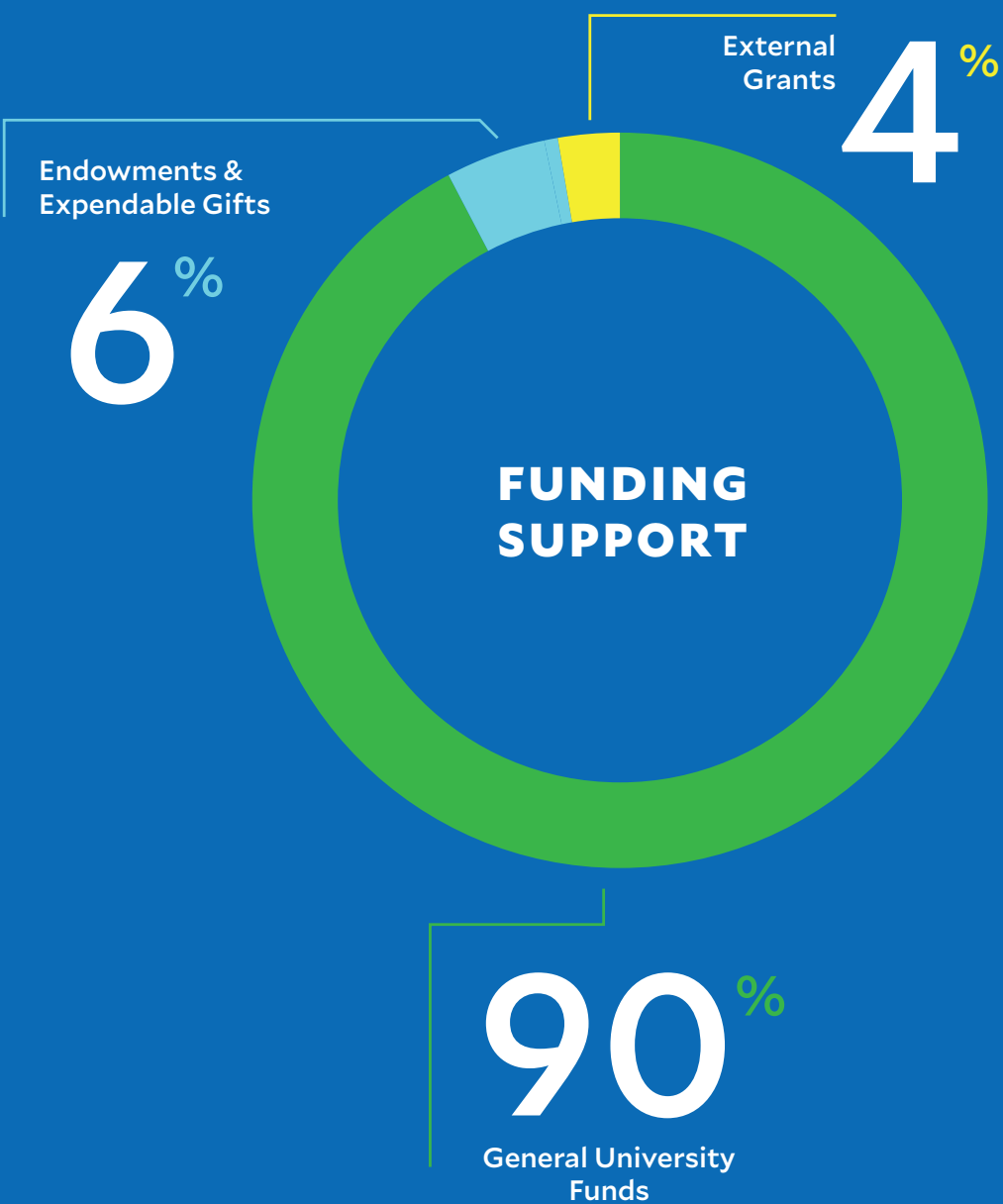
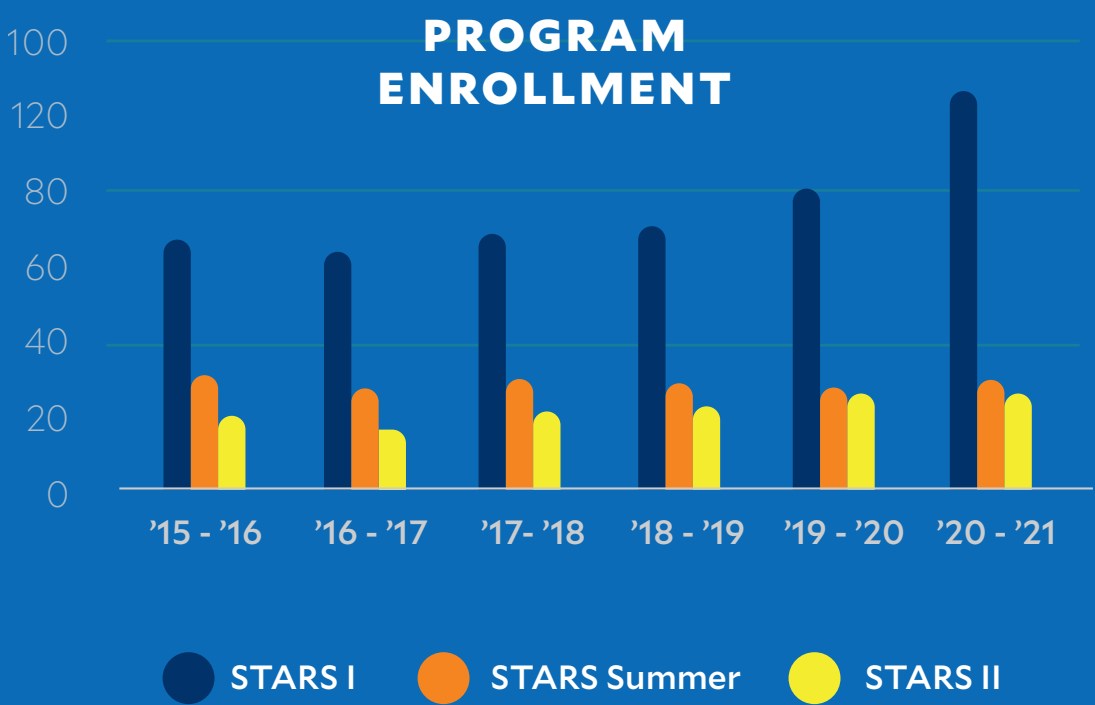
"It was in the labs of Drs. Frederick Naftolin and Kenneth Nelson that I not only learned basic science techniques, but also the importance of asking and pursuing scientific questions."

**Yale '99 BS Molecular, Cellular & Developmental
Biology, Yale School of Medicine '06 MD,
Harvard T.H. Chan School of Public Health '13 MPH**

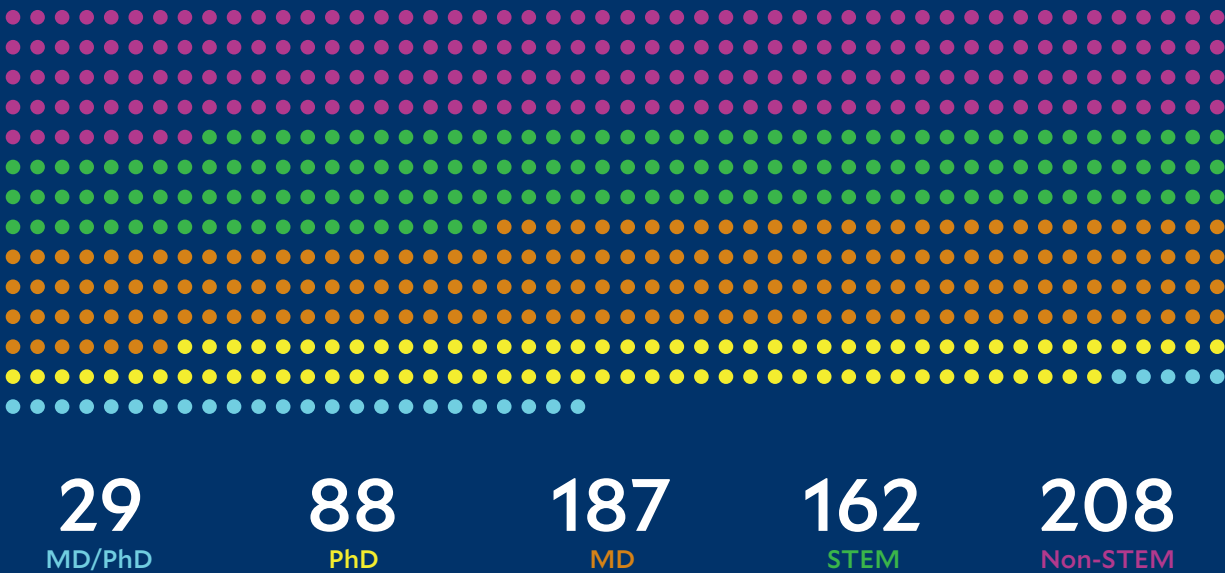
“I began my research career as a Science, Technology and Research Scholar (STARS) member. It was in the labs of Drs. Frederick Naftolin and Kenneth Nelson that I not only learned basic science techniques, but also the importance of asking and pursuing scientific questions. It was Dr. Iona Black who showed me what mentorship looks like and my fellow STARS peers taught me the value of building a scientific network. My experiences as a STARS member challenged me and eventually led me to a career in medicine. I am now a physician scientist devoted to most effectively providing care and implementing educational and management programs for children with sickle cell disease globally. Thank you STARS!”

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STARS AT A GLANCE

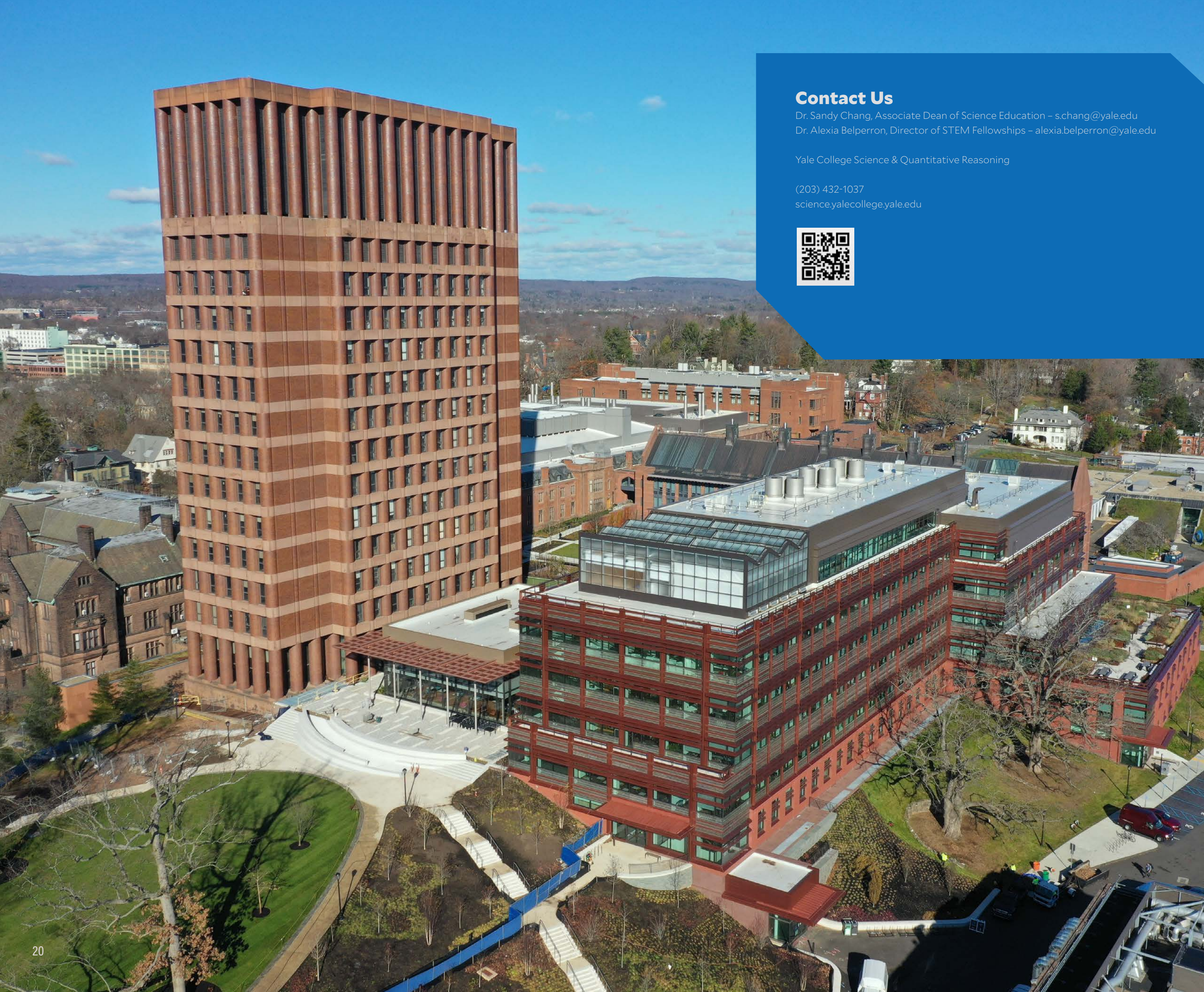


674
KNOWN STUDENT OUTCOMES



Sampling of STARS student destinations, 2018-2020

- Alexia Anderson '20 - PhD program, Univ of Hawaii at Manoa
- Joy Chiu '19 - MD/PhD program, Perelman School of Medicine at the Univ of Pennsylvania
- Deyri Garcia '20 - MPH program, Yale Univ
- Shafeeq Ibraheem '18 - PhD program, Univ of California, Berkeley
- George Iskander '20 - PhD program, Univ of Chicago
- Derek Kao '18 - MD program, Icahn School of Medicine at Mount Sinai
- Jared Peralta '19 - MD program, Univ of California San Francisco School of Medicine
- Kevin Salinas '19 - MD program, Harvard Medical School



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