

# DOE Computational Science Graduate Fellowship Update

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March 29, 2022

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# What is DOE CSGF?

A four-year Ph.D. fellowship program sponsored by U.S. Department of Energy (DOE) focused on the study of science, mathematics, engineering or computer science using high performance computing and mathematical methods

Prepares our nation's best students to become future leaders in Computational Science and Engineering

# The DOE CSGF is a computational science workforce development program

**Help ensure an adequate supply of scientists and engineers** appropriately trained to meet national workforce needs, including those of DOE, in computational science

**Raise the visibility of careers in the computational sciences** and encourage talented students to pursue such careers, thus building the next generation of leaders in the field

**Provide practical work experiences** for the fellows that allow them to encounter the cross-disciplinary, team-based scientific research environment of the DOE National Labs

**Strengthen collaborative ties between the academic community and the DOE National Labs** so the fellowship's multidisciplinary nature builds the national community of computational scientists



2008 Fellows

# Fellows receive broad exposure to interdisciplinary science



An interdisciplinary program of study, including courses in

Science & Engineering, Mathematics,  
Computer Science, High Performance Computing



At least one 12-week practicum at a DOE Laboratory

Research in an area distinct from the thesis topic as a broadening experience



Participation in the CSGF Annual Review

share research, network with other fellows, scientists from Labs,  
industry and academia, and Federal program managers

# Eligibility is defined to ensure the Fellowship can impact the Fellows' graduate experience

- US Citizens or lawful permanent residents planning full-time uninterrupted study toward a PhD at an accredited university in the US
- Senior undergraduate and first year graduate students pursuing doctoral degrees in physical, engineering, computer, mathematical or life sciences



# The Fellowship provides generous benefits with up to four years of support

- \$45K/year stipend
- Full tuition
- \$1000/yr Professional Development allowance
- Additional support to cover additional expenses of practicum
- Travel expenses for participation in annual Program Review
- Travel expenses for first-year fellows to participate in SC

<https://www.krellinst.org/csgf/about-doe-csgf/benefits-opportunities>

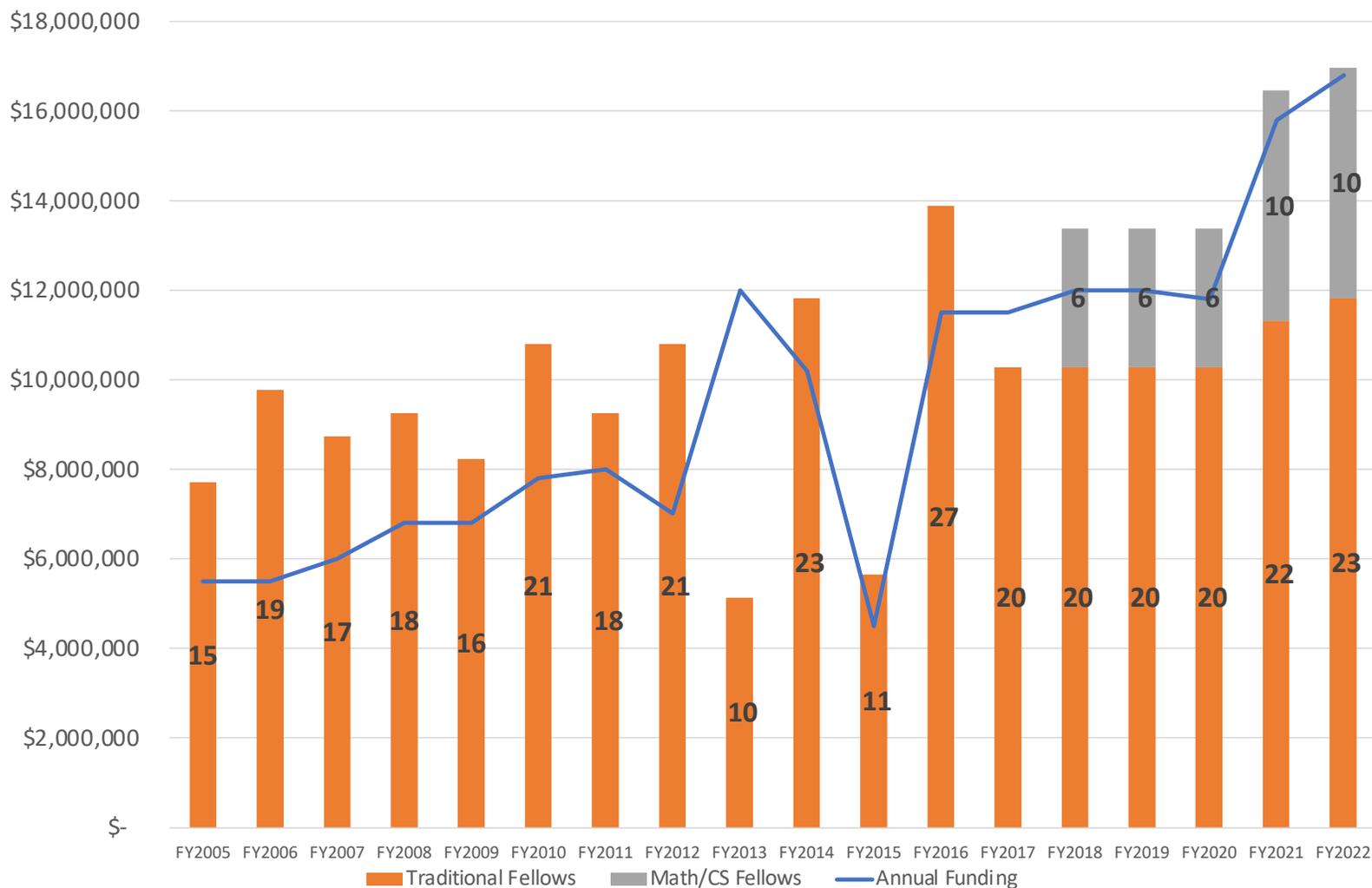




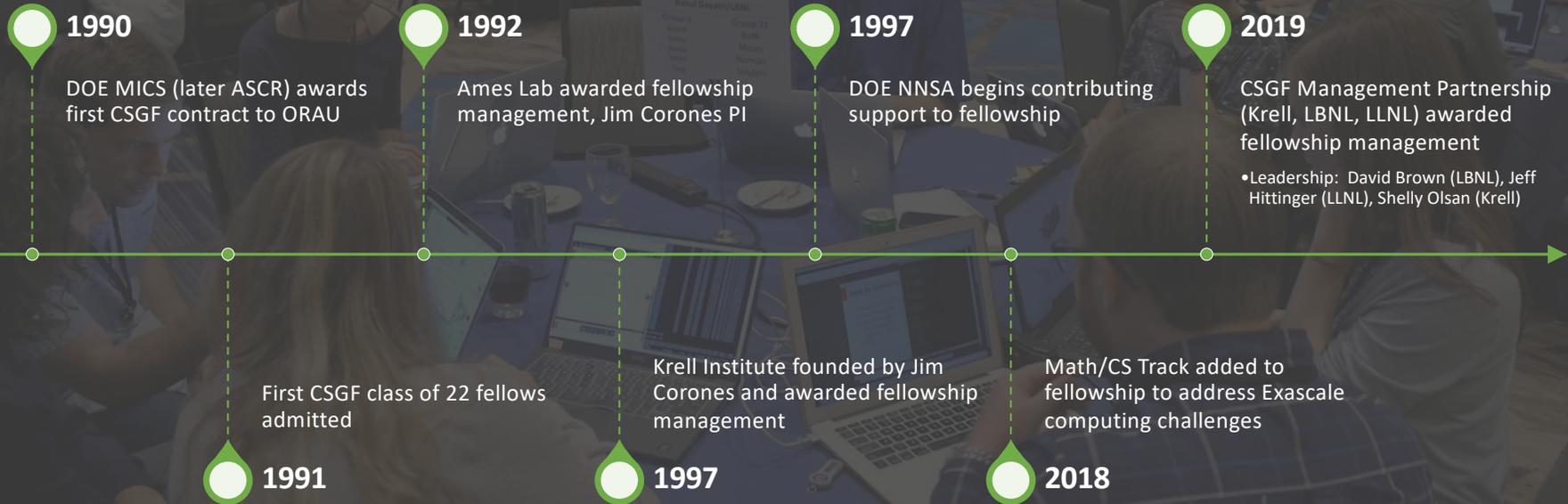
## Updates FY 2022

- Total annual budget for CSGF increased to \$17M
  - The FY2022 budget just approved and signed increases ASCR support from \$10M to \$15M per year
  - NNSA/ASC continues to contribute \$2M per year to support the program
- CSGF Steering Committee approved increase of fellowship stipend from \$38,000/yr to \$45,000/yr for all fellows beginning this fall

# Historical Funding Levels and number of Awards



# CSGF Key Milestones



The DOE CSGF Management Partnership administers the Fellowship program



David Brown  
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National Lab  
Technical PI

Shelly Olsan  
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PI

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The DOE CSGF Steering Committee advises and supports the Fellowship program



Silvia Crivelli  
UC Berkeley



John Dolbow  
Duke  
University



Roscoe Giles  
Boston  
University



James Hack, chair  
Oak Ridge  
Nat'l Lab (ret.)



Aric Hagberg  
Los Alamos  
Nat'l Lab



Mary Hall  
University of  
Utah



Judith Hill  
Lawrence  
Livermore  
Nat'l Lab



David Keyes  
King Abdullah  
University of  
Science and  
Technology



Robert Voigt  
Leidos

# For more info in CSGF history...

Computing in Science & Engineering

## The Early Years and Evolution of the DOE Computational Science Graduate Fellowship Program

Nov.-Dec. 2021, pp. 9-15, vol. 23

DOI Bookmark: [10.1109/MCSE.2021.3120689](https://doi.org/10.1109/MCSE.2021.3120689)

The U.S. Department of Energy Computational Graduate Fellowship Program, celebrating 30 years of existence in 2021, is one of the most successful graduate fellowships in the world as well as one of the longest running programs in the U.S. Department of Energy. This article discusses the conception, early years and evolution of the fellowship over the past thirty years.

1  
2 **THEME ARTICLE: DOE COMPUTATIONAL SCIENCE GRADUATE FELLOWSHIP RESEARCH SHOWCASE**

### 4 The Early Years and Evolution of the DOE 5 Computational Science Graduate Fellowship 6 Program

7 David Brown , Lawrence Berkeley National Laboratory, Berkeley, CA, 94720, USA

8 James Hack, Oak Ridge National Laboratory, Oak Ridge, TN, 37830, USA

9 Robert Voigt, Leidos, Reston, VA, 20190, USA

11 *The U.S. Department of Energy Computational Graduate Fellowship Program, celebrating 30 years of existence in 2021, is one of the most successful graduate fellowships in the world as well as one of the longest running programs in the U.S. Department of Energy. This article discusses the conception, early years and evolution of the fellowship over the past thirty years.*

#### 16 **FOUNDING THE FELLOWSHIP**

17 **W**hen a group of scientists and engineers  
18 from across the U.S. gathered in a hotel  
19 meeting room in Washington, DC, in mid-  
20 October, 1990, they had little inkling that the new pro-  
21 gram they were founding was to become one of the  
22 most successful graduate fellowships in the world, as  
23 well as one of the longest running programs in the U.S.  
24 Department of Energy [DOE]. This committee met to  
25 develop a solution to a challenging problem for the  
26 U.S. DOE National Laboratories. Home to a good frac-  
27 tion of the world's high performance "supercom-  
28 puters," the Laboratories were having a difficult time  
29 finding and recruiting new staff who had the skills to  
30 use those computers effectively to deal with the major  
31 interdisciplinary scientific and engineering challenges  
32 that the Laboratories were known for addressing. A  
33 general observation, agreed upon by those present,  
34 was that U.S. and international academia were largely  
35 unsuccessful in training graduate students in the skills  
36 needed to succeed in the newly emerging high-perfor-  
37 mance computing (HPC) world. A new four-year gradu-  
38 ate fellowship program was proposed as a solution,  
39 and it needed to have some unique properties to suc-  
40 cessfully address the challenges. The attendees were  
41 well-known leaders in applied mathematics and high-

performance computing from academia and govern-  
42 ment laboratories, including Peter Lax, Director of the  
43 Courant Institute, Robert Voigt, Director of ICASE,  
44 Paul Woodward, from the Army High Performance  
45 Computing Research Center in Minneapolis, Phillip  
46 Colella, from the Mechanical Engineering Department  
47 at University of California at Berkeley, Susan Ying,  
48 from the Aeronautics Department at Florida State Uni-  
49 versity, Paul Turinsky, from the Department of Nuclear  
50 Engineering at North Carolina State University, Ed Oll-  
51 iver from Oak Ridge National Laboratory, Patrick Burns  
52 from Colorado State University, James Hack from the  
53 National Center for Atmospheric Research, David Kuck  
54 from the University of Illinois, Edward Theil from Law-  
55 rence Berkeley National Lab, Jorge Moré from Argonne  
56 National Lab, Peter Jensen from Georgia Tech, and  
57 David Brown from Los Alamos National Lab. Repre-  
58 senting the U.S. DOE Applied Mathematical Sciences  
59 (AMS) program were Gary Johnson and John Cavallini.  
60 The Oak Ridge Association of Universities (ORAU), who  
61 became the initial managers of the fellowship program,  
62 was represented by Craig Williamson.  
63 It seems surprising now that one of the open ques-  
64 tions was what to call the new program. The terminol-  
65 ogy used to describe the research activity was varied:  
66 one of the most common terms in use at the time was  
67 "scientific computing." Both "computational physics"  
68 and "computational fluid dynamics" (CFD) were well  
69 established by this time (albeit in a largely two-dimen-  
70 sional or "shallow water" world), but both terms  
71 described fields narrower than what was envisioned  
72 for this new program. The term "computational" 73

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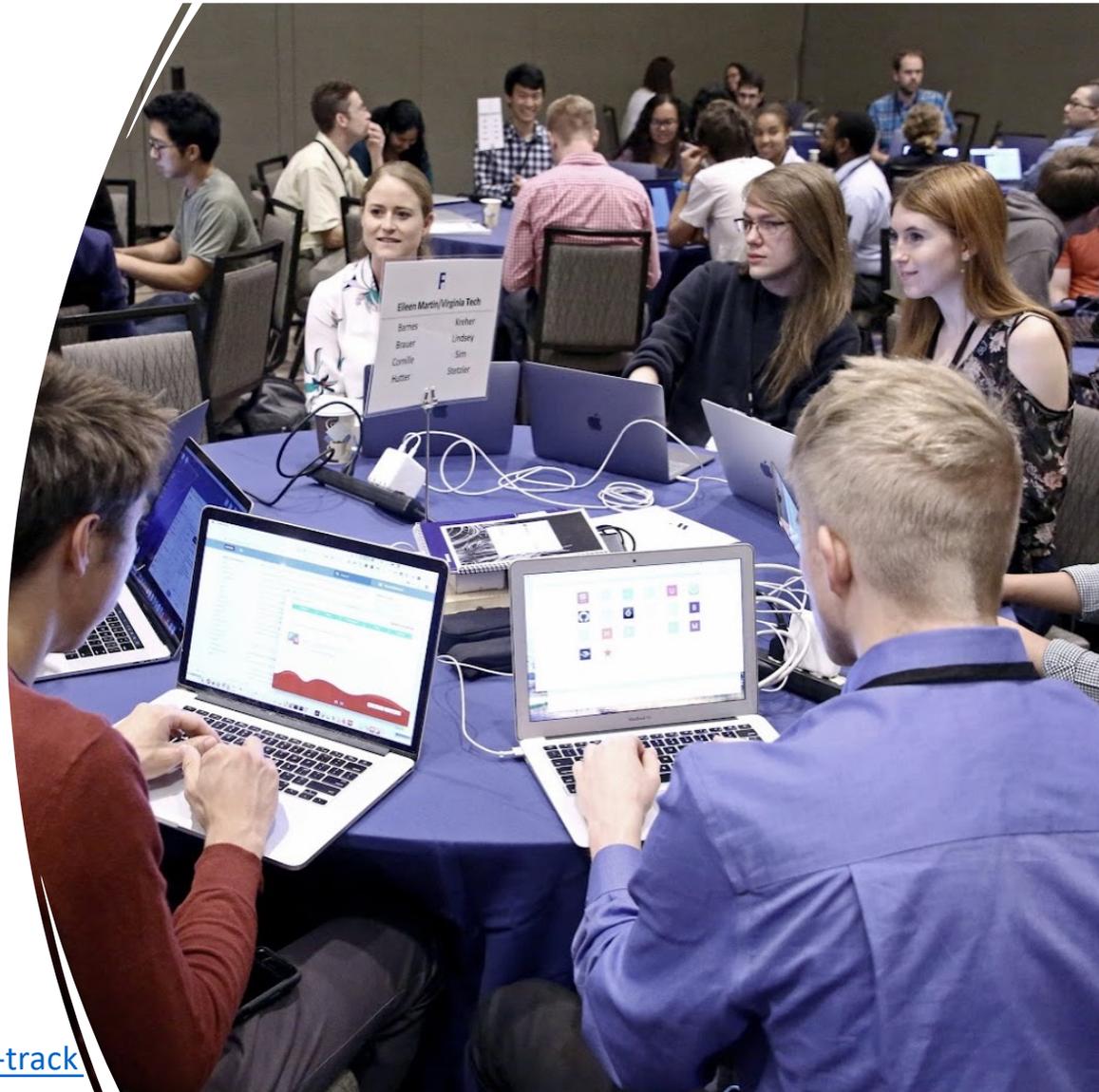
Computing in Science & Engineering

1

## Since 2018, applicants can apply to one of two CSGF tracks

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- “Traditional Track”:
  - doctoral candidates in fields of study that advance the use of high-performance computing (HPC) to solve specific, complex science and engineering problems.
- “Mathematics/Computer Science Track”:
  - doctoral candidates researching HPC-enabling technologies in applied mathematics, statistics or computer science
  - Unlike traditional DOE CSGF students, Math/Computer Science fellows need not focus on a particular science or engineering application.



<https://www.krellinst.org/csgf/about-doe-csgf/math-cs-track>

# 2021 Longitudinal Study documents quality of fellowship and looks closely at diversity, inclusion

“The data from this study indicate that the DOE CSGF is a highly sought-after fellowship that draws some of the most promising students in science, technology, engineering, and mathematics, typically from the country’s leading universities”

“The program actively takes steps to include a diverse set of individuals within the relatively small number of recipients each year”

“The program ... works to create an environment in which those from various backgrounds feel supported and their perspectives are valued”

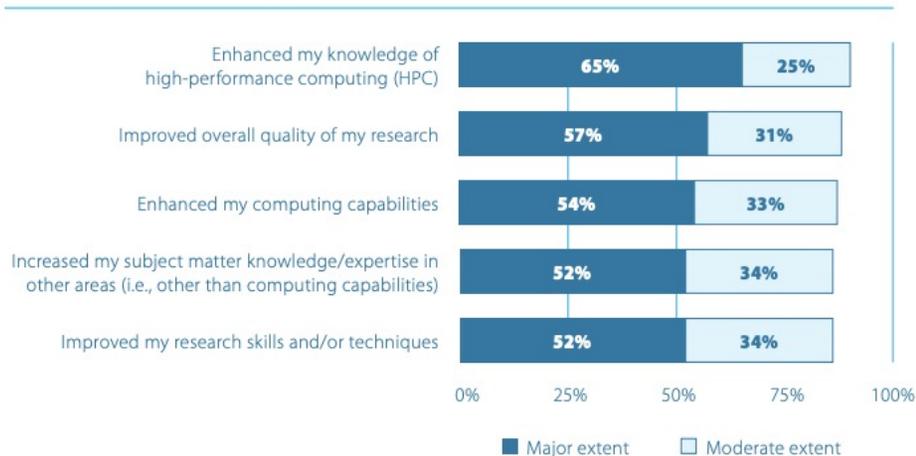
<https://www.krellinst.org/csgf/study>



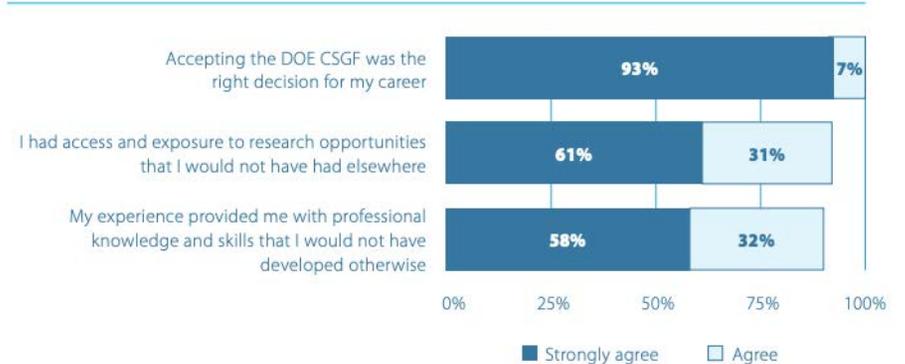
56% response rate from CSGF fellows and alumni

# A strong majority of alumni report moderate to major impact of fellowship on their careers

**Figure 1.** | Percentage of alumni reporting benefits from participation in the DOE CSGF program

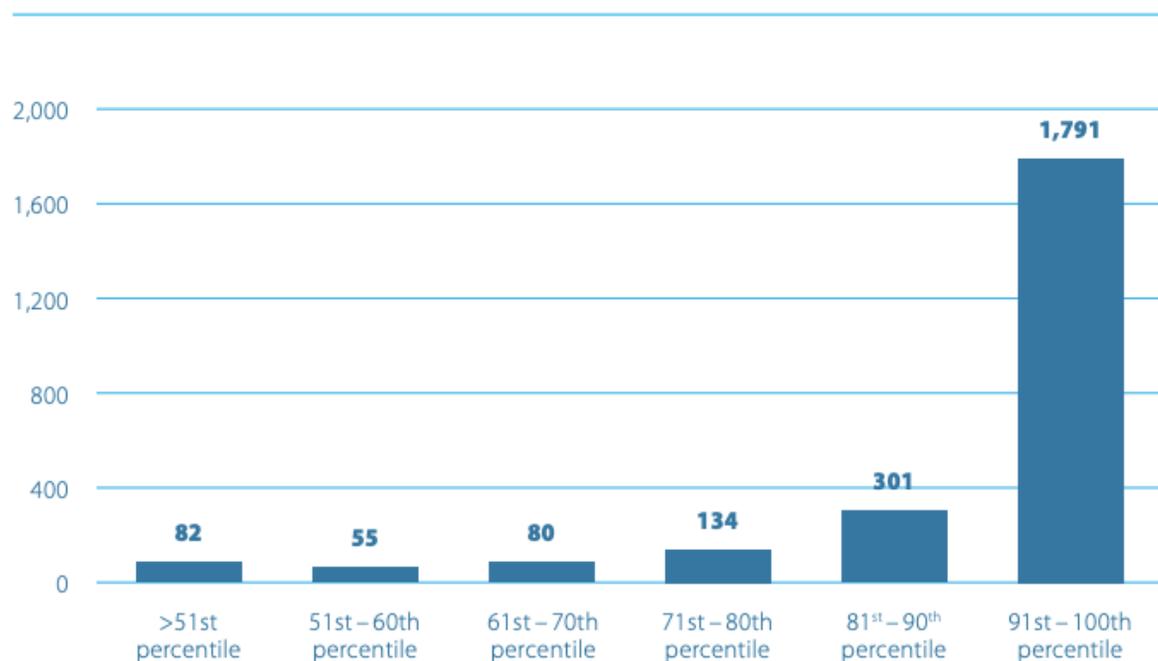


**Figure 2.** | Percentage of alumni reporting on the impacts of their participation in the DOE CSGF program



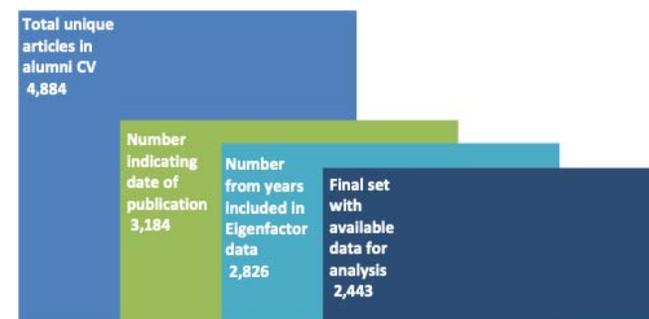
# Publication impact of CSGF alums is very high

**Figure 3.** | Eigenfactor (EF) score percentile rankings of journal articles published by DOE CSGF alumni



**83%** (1,791) were published in journals with an average EF score of 24, i.e. **24x influence of average journal**

The Eigenfactor Project's EF score is essentially the ratio of number of citations to total number of articles in a journal





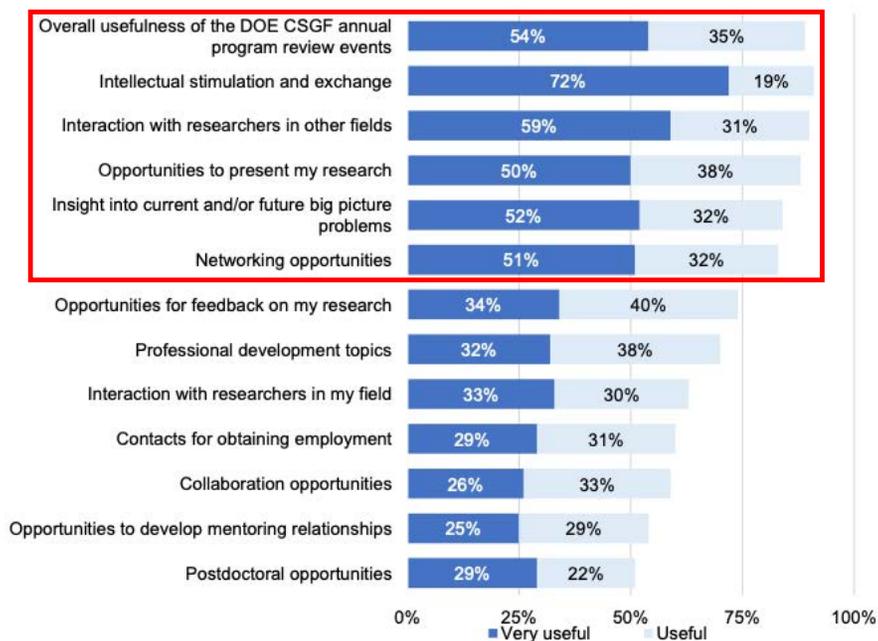
## Annual Program Review

- Fellows present their research
- Program sponsors have opportunity to meet fellows, evaluate the program
- Fellows learn about Lab practicum and employment opportunities
- Many additional programs including career advice



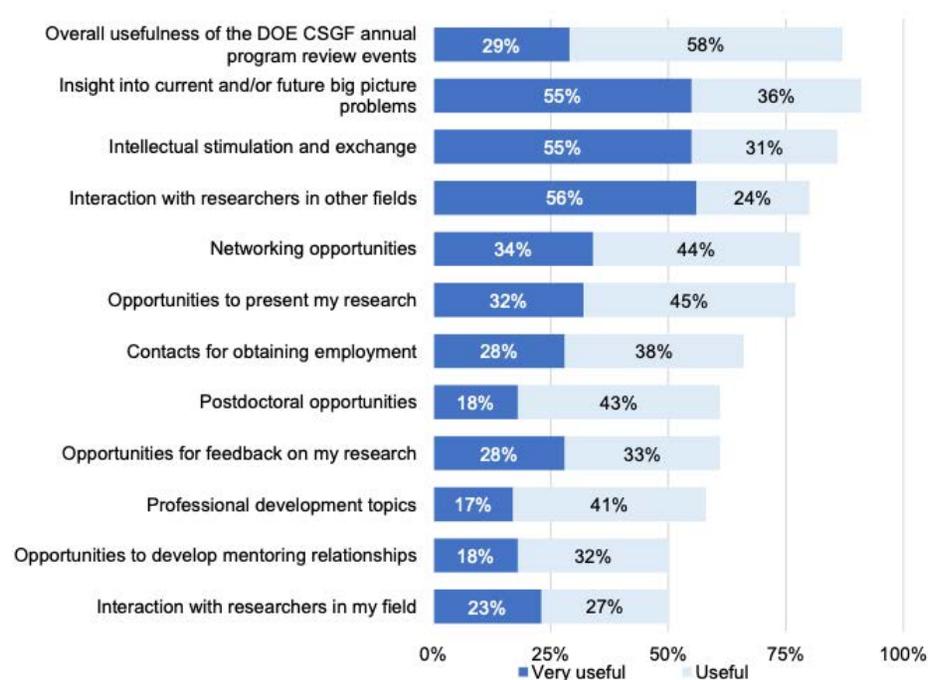
# Fellows agree on high value of the Annual Program Review

Figure 4-3. Percent of alumni reporting on the usefulness of the elements of the annual program review meetings (N=213)



Alums

Figure 4-4. Percent of current fellows reporting on the usefulness of the elements of the annual program review meetings (N=83)



Current Fellows



CSGF Class of 2019 1<sup>st</sup> year Fellows attend SC19 in Denver Colorado, November 2019

*Additional HPC Training:*  
Fellows attend Supercomputing conference HPC workshops and tutorials



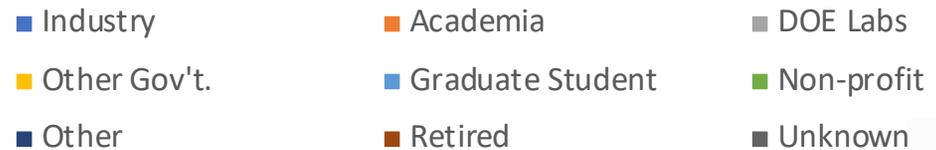
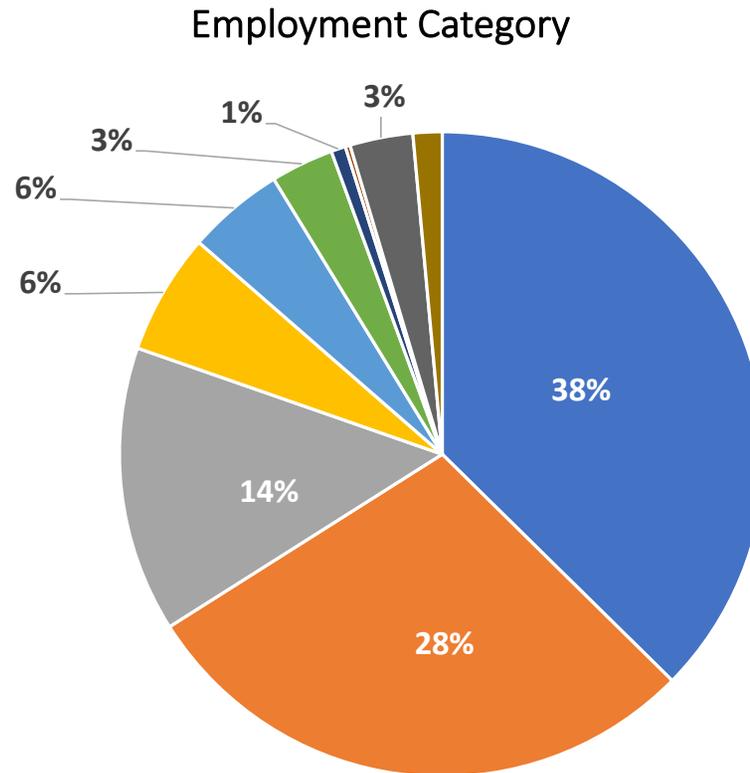
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# CSGF Demographics

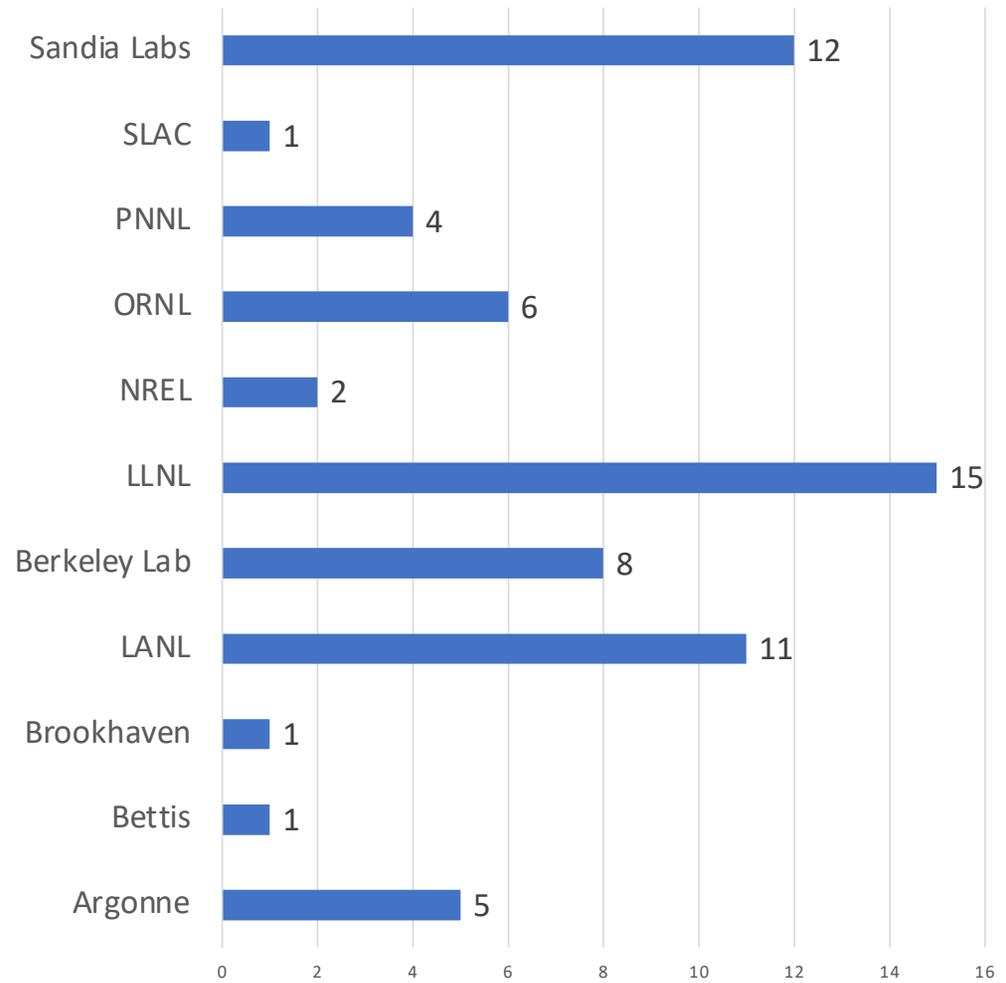
## 451 DOE CSGF Alumni living and working across the US and around the world

• Industry	173
• Academia	127
• DOE Labs	66
• Grad. Student	28
• Other Gov't	26
• Non-profit	12
• Other	3
• DOE Appointment	1
• [Unknown	15]
• [Deceased	7]

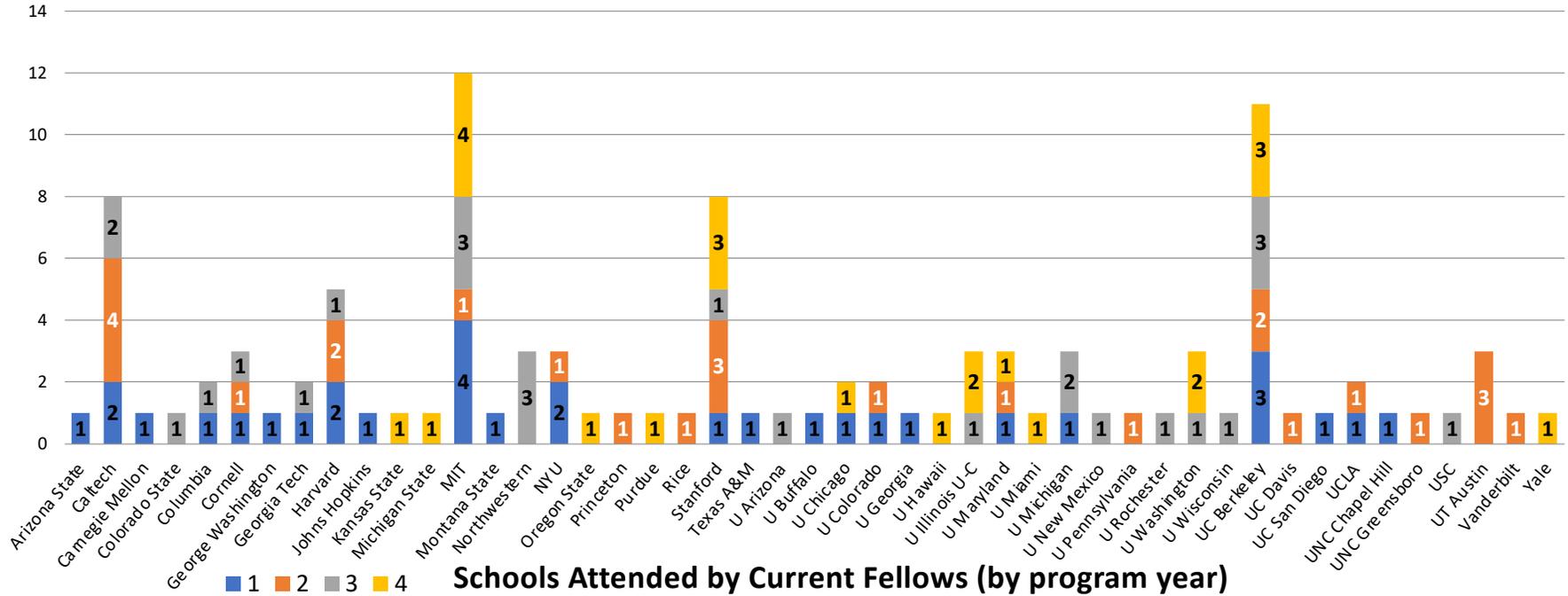
• All information is self-reported and categorized by alumni



66 CSGF Alumni  
currently  
employed at  
DOE  
Laboratories

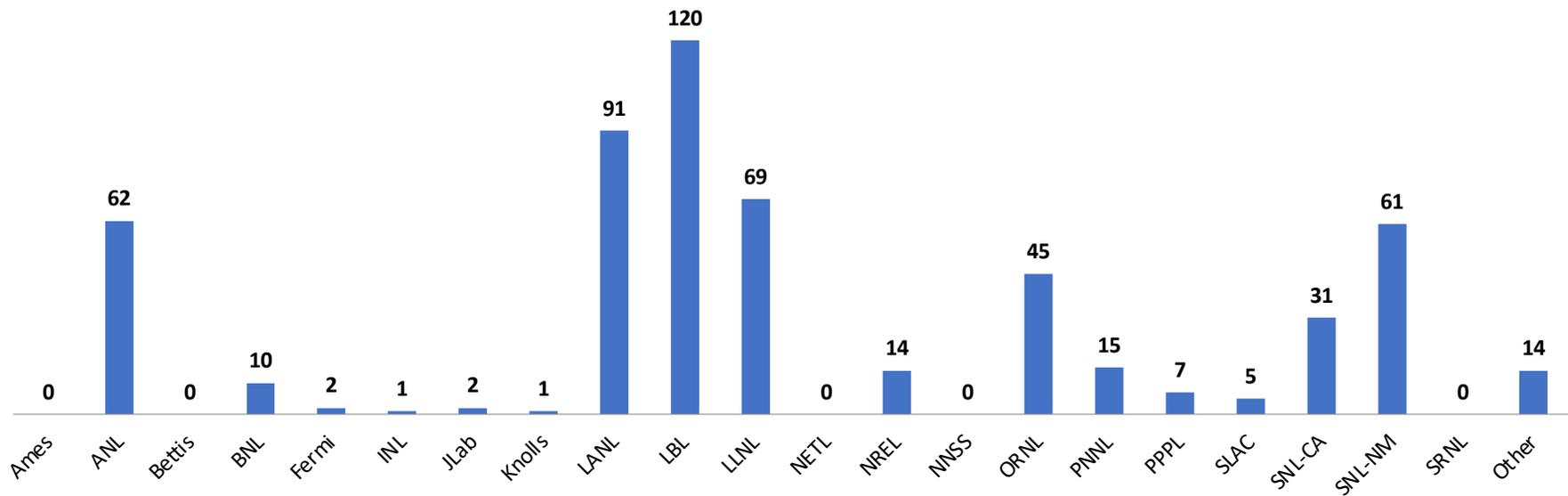


# Current Fellows attend 76 universities



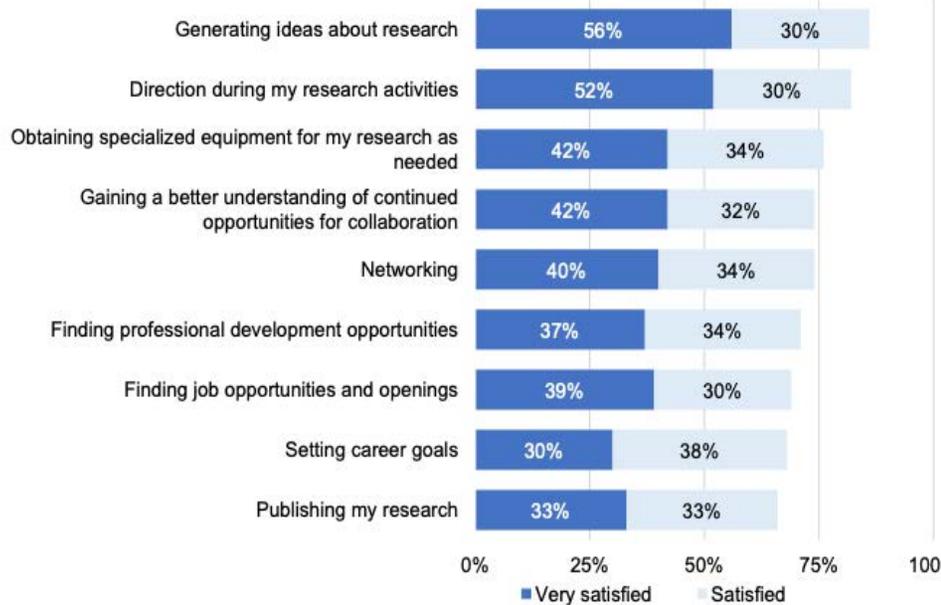
# Most DOE Labs have hosted fellow practicums

Completed Practicums by DOE Laboratory, 1992-2020



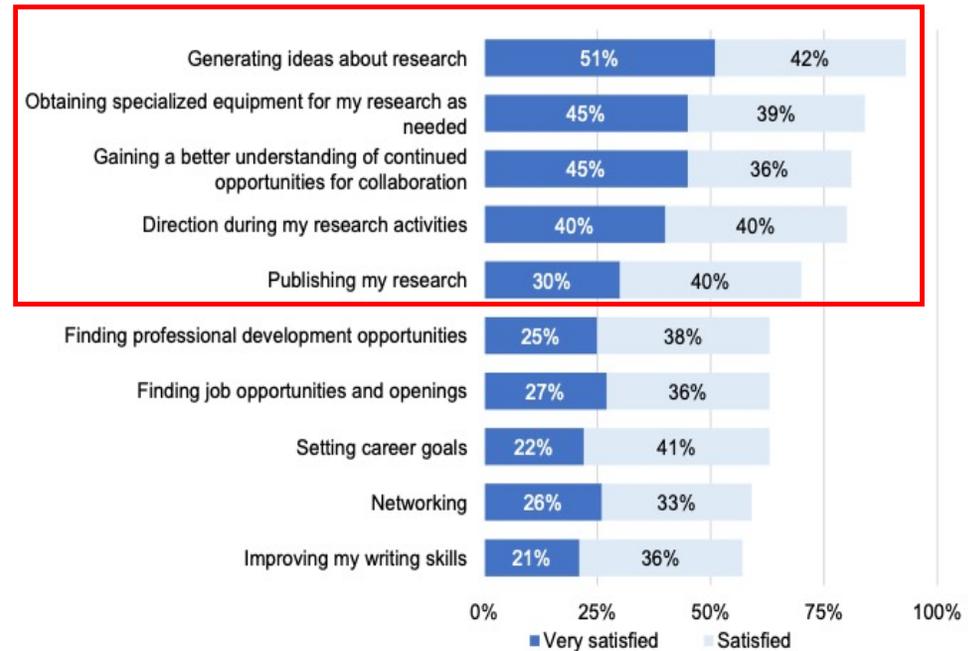
# Fellows show very high satisfaction with the practicum experience

Figure 4-1. Percent of alumni reporting levels of satisfaction with support received from practicum site supervisor and laboratory staff (N=213)



Alums

Figure 4-2. Percent of current fellows reporting levels of satisfaction with support received from practicum site supervisor and laboratory staff (N=83)



Current Fellows

The image features a dark blue background with a large, faint, light blue circle centered horizontally. A vertical line of a slightly darker shade of blue runs through the center of the circle. The text "CSGF Selection" is centered horizontally and positioned in the upper half of the image.

# CSGF Selection

# Krell's Recruitment Efforts target many communities

## Conferences

- National Society of Black Engineers (NSBE)
- ACM Richard Tapia Celebration of Diversity in Computing (TAPIA)
- Society for Advancement of Chicanos/Hispanics and Native Americans (SACNAS)
- Society of Women Engineers (SWE)
- Society of Hispanic Professional Engineers (SHPE)
- Grace Hopper Celebration of Women in Computing (Grace Hopper)
- Emerging Researchers National Conference in Science, Technology, Engineering and Mathematics – aimed at underrepresented minorities and persons with disabilities - (ERN)

## Career Fairs scheduled this year

- Florida A & M University All Majors Career Fair
- Hampton University Graduate and Professional School Fair
- New Orleans HBCU Virtual Career Fair
- Tuskegee University Career Fair
- Atlanta University Center Consortium Career Fair

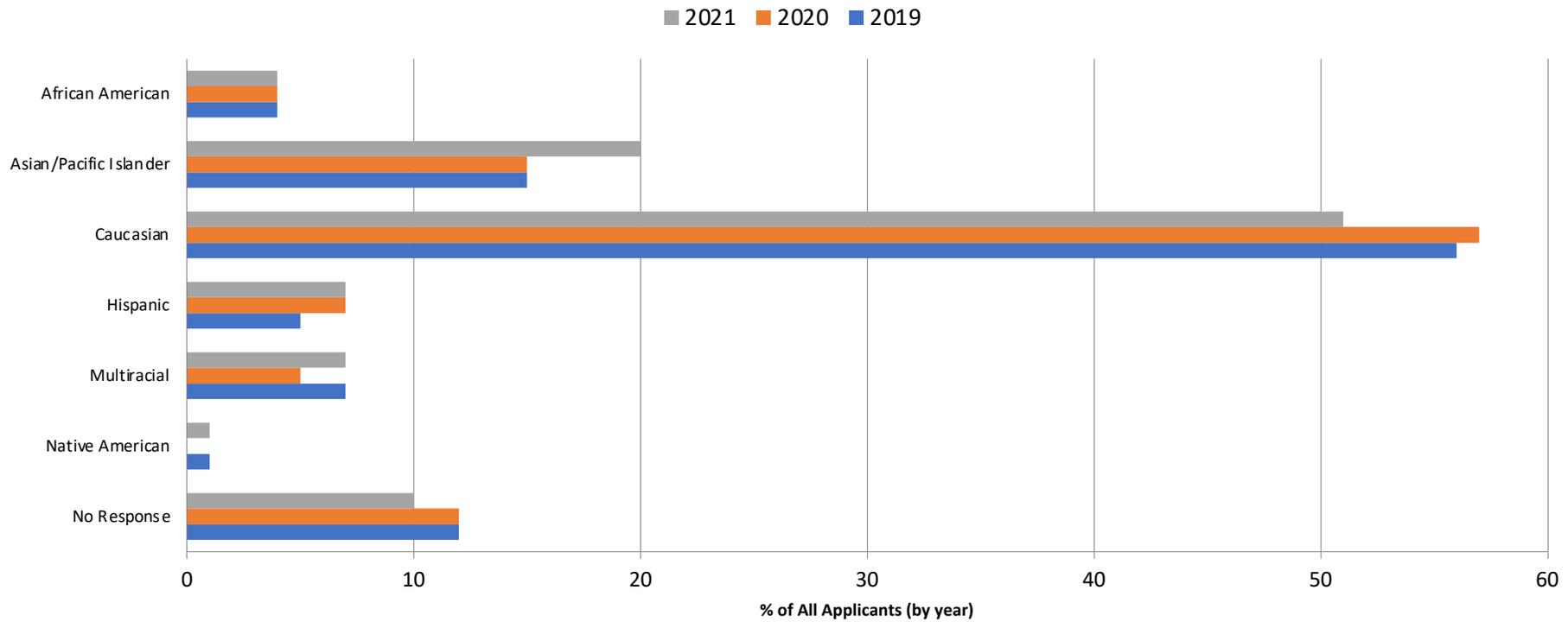
## Virtual info sessions

- Howard University
- Florida A&M
- Xavier University of LA
- Dillard University
- Tuskegee University
- Morehouse College
- Spelman College
- Clark Atlanta University
- ... and more



# Diversity of the applicant pool has been strong in recent years

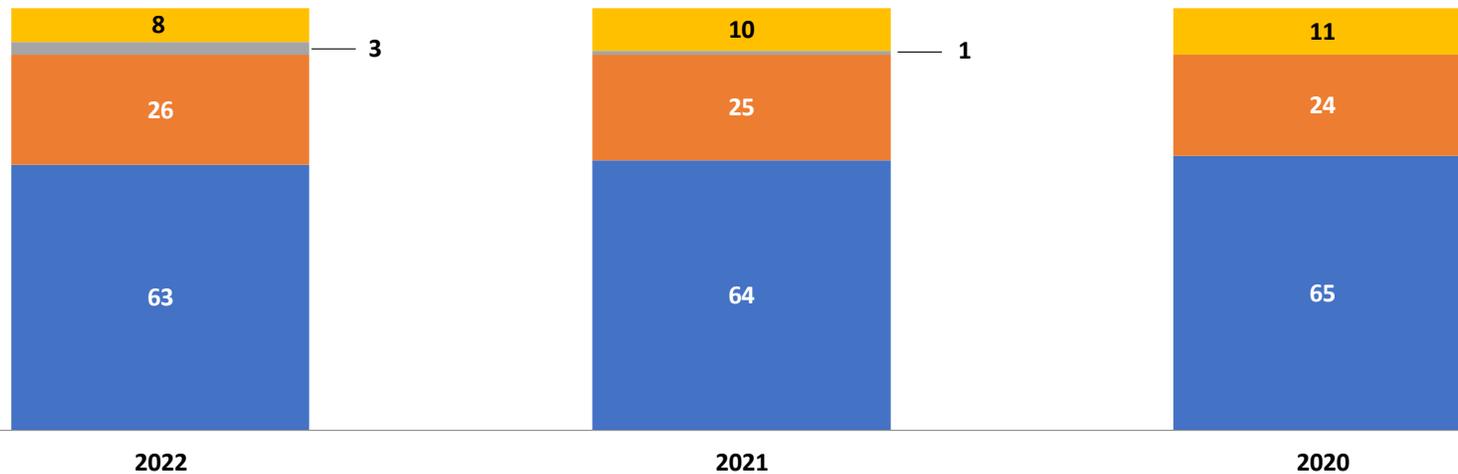
### All Applicants by Race, 2019-2021 (%)



Gender distribution of applicant pool reflects that of the general scientific community

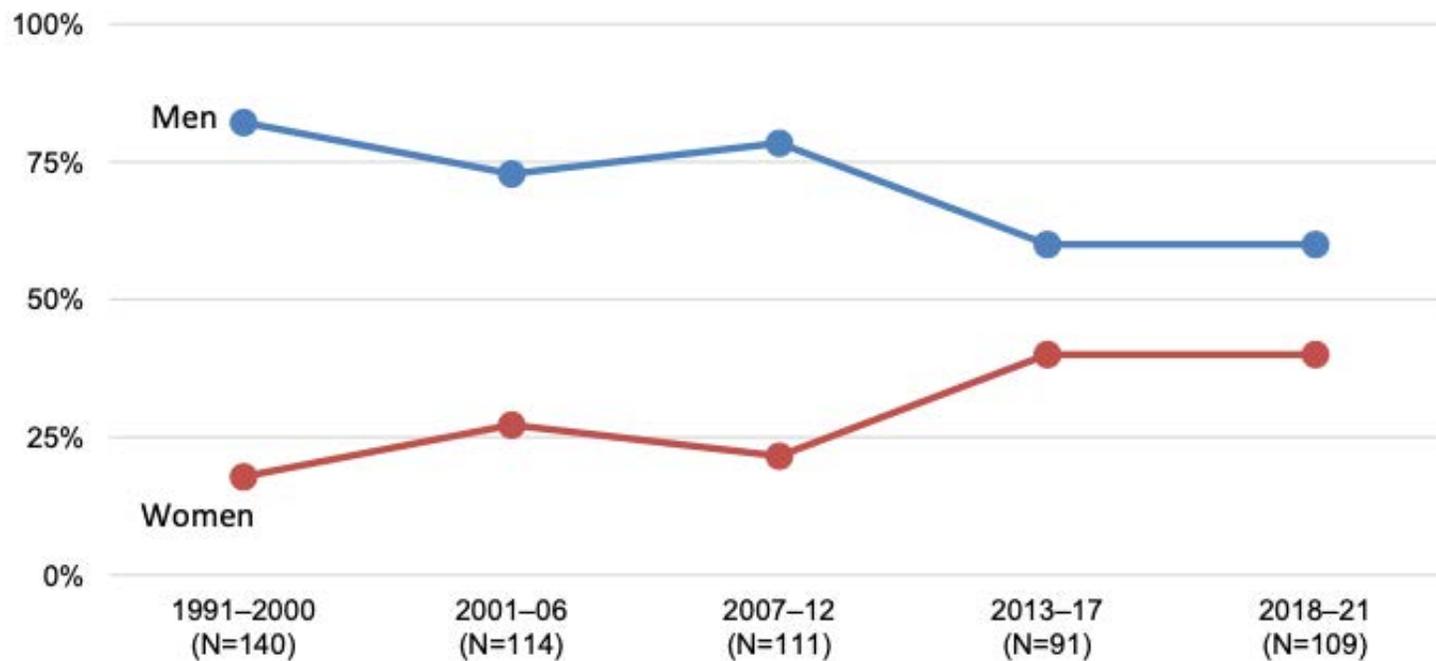
**All Applicants by Gender, 2020-2022 (%)**

■ Male      ■ Female      ■ Non-Binary OR Prefers to Self-Describe      ■ Did Not Report

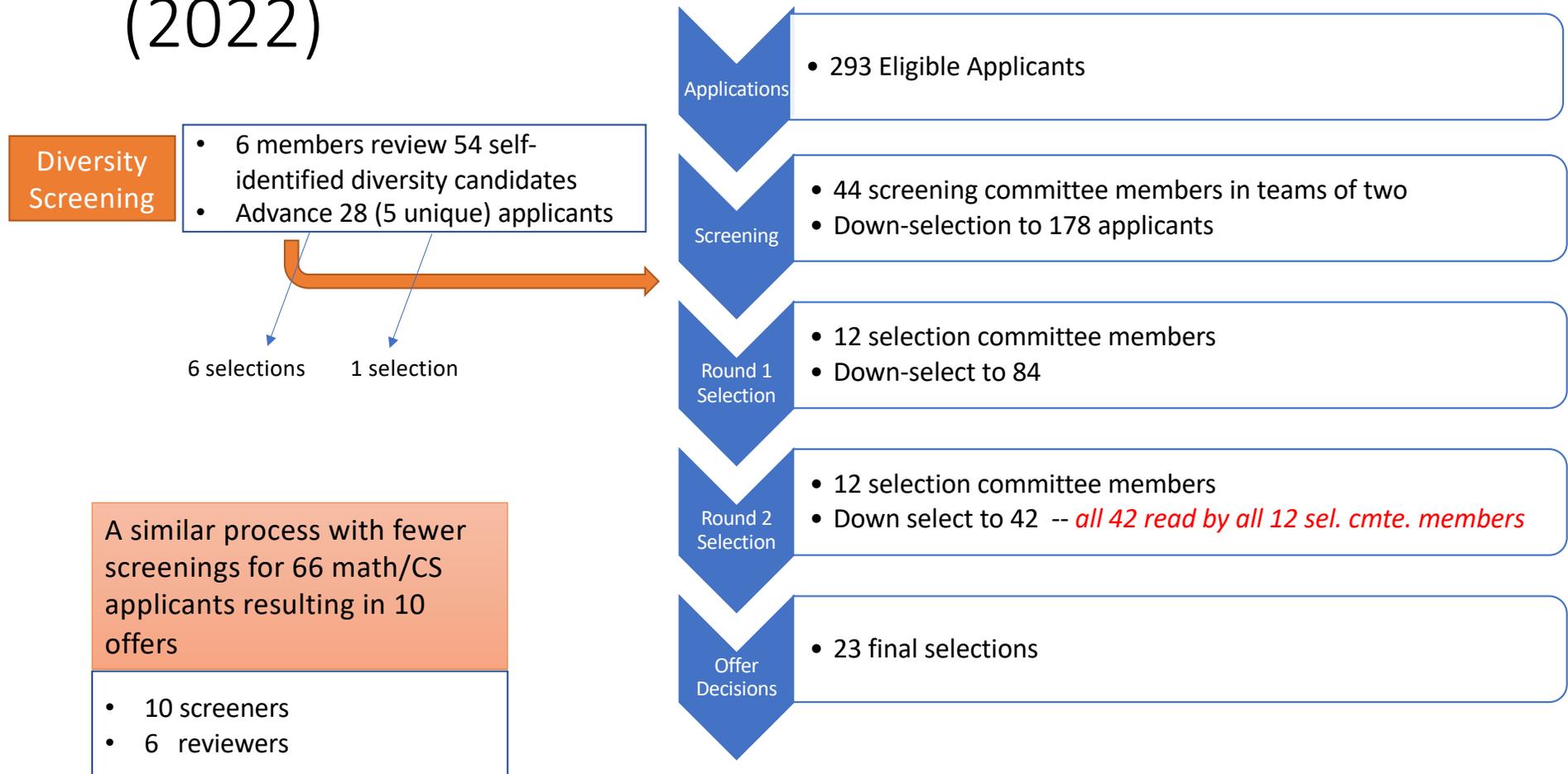


# The fellowship has attained near gender parity in recent years

Figure 2-2. Gender makeup of DOE CSGF recipients, by cohort

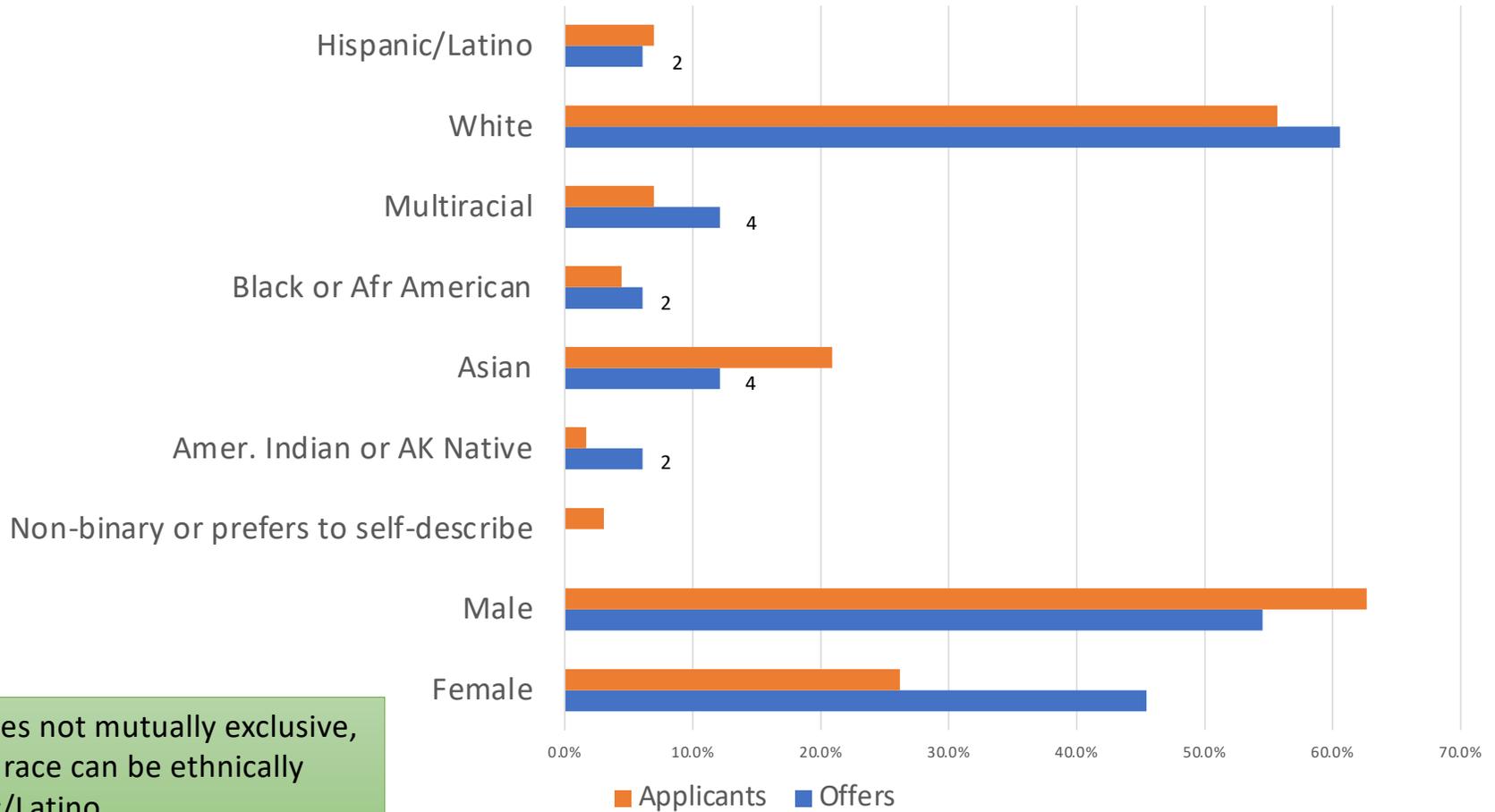


# Review process for CSGF “Traditional” Track (2022)



Every application read by at least two reviewers; more read at each stage of selection

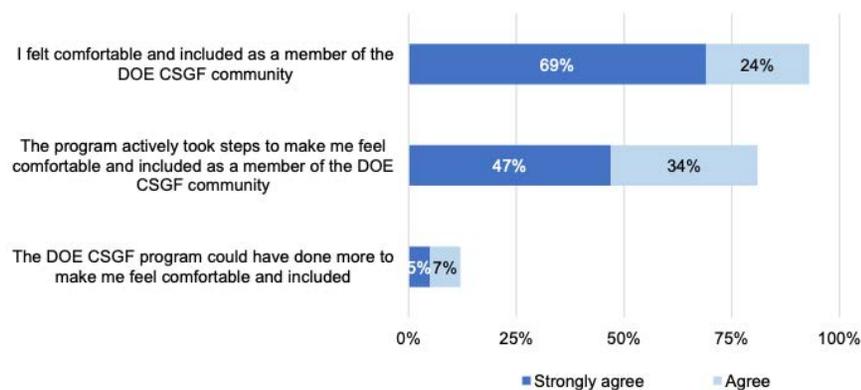
# Diversity of CSGF Fellow Offers 2022



Categories not mutually exclusive, e.g. Any race can be ethnically Hispanic/Latino

# Diversity and Inclusion in the Fellowship as reported by fellows

Figure 4-29. Percent of alumni reporting the extent to which they felt included and the extent to which the DOE CSGF program creates a diverse and inclusive climate (N=213)



*"I don't know what efforts were being conducted by the program to promote diversity but I can say that when joining the program, I certainly was happy to see that there was more gender diversity than anticipated in a high-performance computing, Department of Energy, research scientist-type program. As the years progressed, it certainly seemed like there was greater ethnic diversity and military status diversity, and things like this that I had noticed more ... I don't know what efforts went into that, I don't know if it was recruiting focus or just a more well-rounded applicant evaluation process, but I felt like it was trending upwards in my time there".*

*"I always felt inclusivity within the community of CSGF, and it was clear to me that it was really an area of focus. The fellowship was thinking about that, they were thinking about how to really build a community of scientists where we could all learn from each other, where we could all get exposure to different perspectives, and I just always felt very, very supported by that. We were encouraged not to get too stuck in our boxes of whatever perspective we were coming from, whether that's a cultural background or our technical backgrounds. I think the fellowship was very intentional in trying to break us out of that, and I think it worked. It worked really, really well".*

# 43 2022 finalists from 31 UG institutions

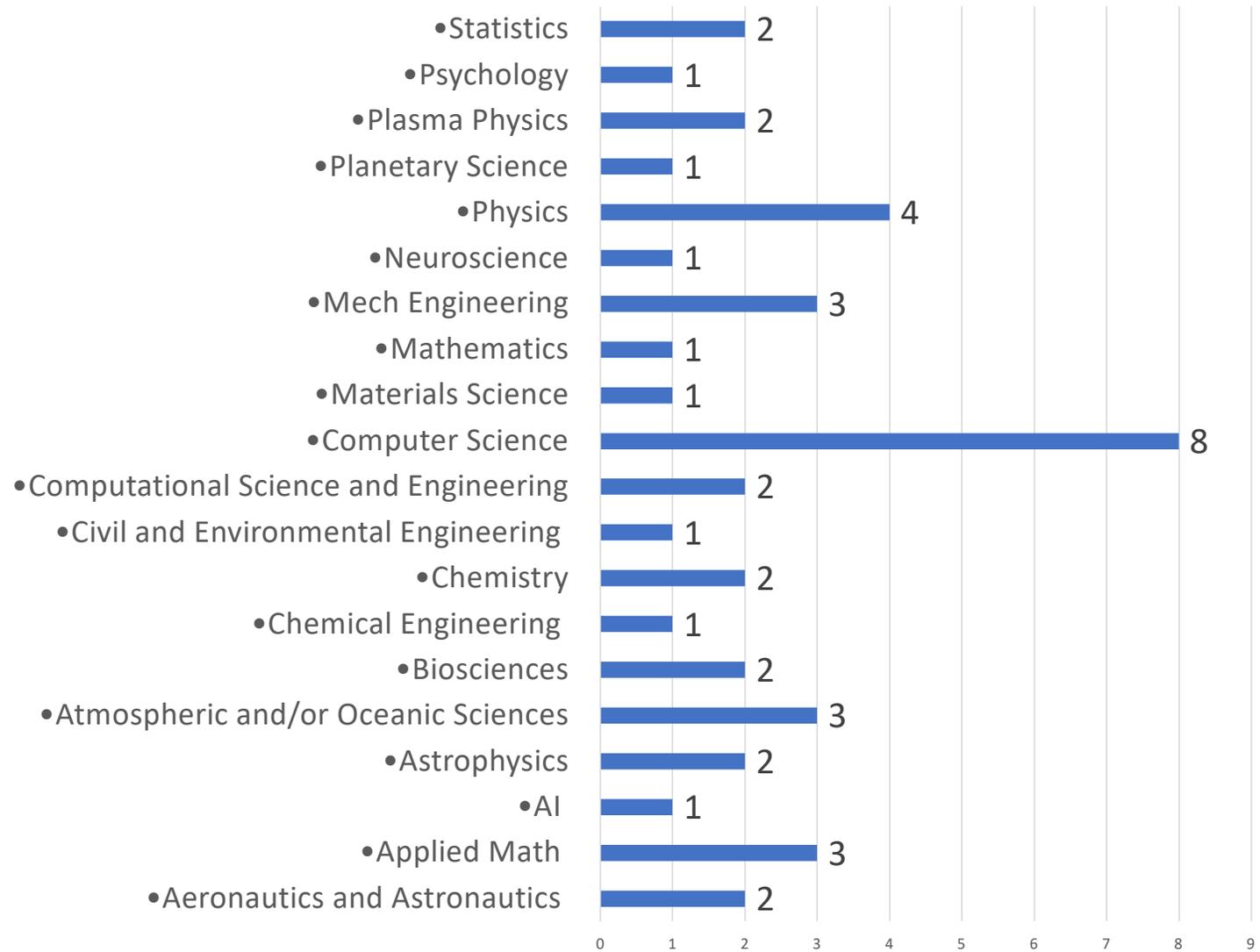
## Undergrad Institution

Ball State	Johns Hopkins (3)	U Illinois U-C
Bowdoin College	Kenyon College (2)	U Maryland, Baltimore County
Citadel	Mary Baldwin	U Maryland, College Park (2)
Clemson	MIT (2)	U Missouri (2)
Dartmouth College	Northeastern	U North Carolina
Duke	Portland State	U Washington
Florida International	Princeton (2)	Wellesley College
Fordham	Stanford (3)	UCLA
Georgia Tech	UCLA	Western New Mexico
Harvard College	U Colorado	
Harvard (3)	U Delaware (2)	
	U Hawaii, Manoa	

## 1<sup>st</sup> choice PhD Institutions

Caltech (2)	UC Berkeley (3)
Carnegie Mellon	U Chicago
Columbia	U Colorado (2)
Cornell	U Hawaii, Manoa
Duke	U Maryland, College Park (2)
Emory	U Minnesota
MIT (12)	U Pennsylvania
Northwestern	U Texas (2)
Portland State	U Washington (3)
Princeton	
Stanford (4)	
U Alabama	

# 2022 Finalists Fields of Study





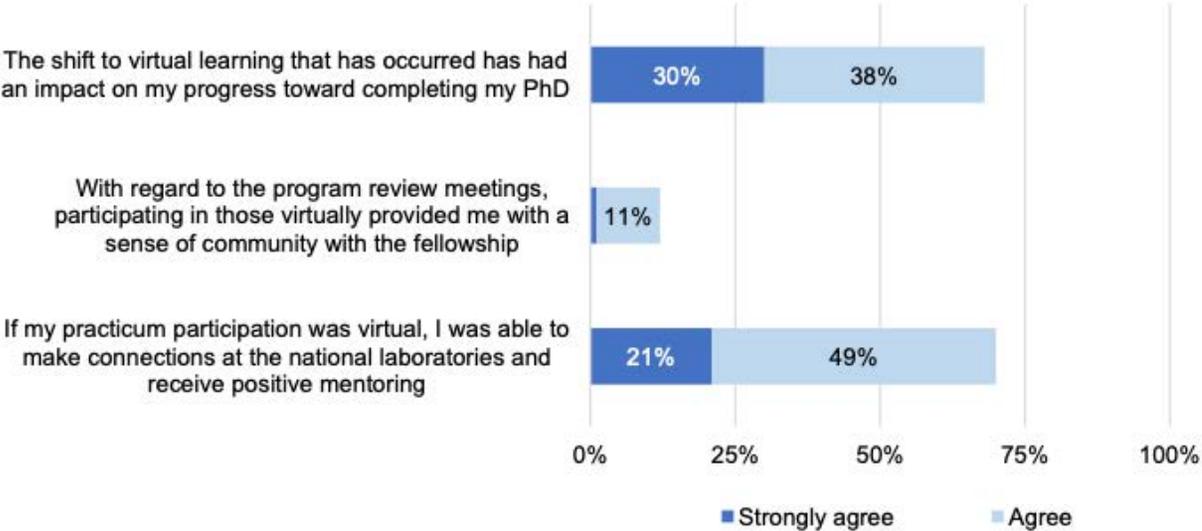
COVID-19

# COVID-19 impacts on fellowship

- 2020 - All 1<sup>st</sup> Practicums suspended
  - Affected fellows given an additional year to complete practicum requirement
- 2021 - 43 Practicums completed – all virtual except 3
- 2022 – 37 Practicums planned – all expected to be onsite at Labs
  
- CSGF Annual Review conducted virtually in 2020 and 2021
- (+) Families of 4<sup>th</sup> year fellows able to attend virtually
- CSGF 2022 Annual Review will be in person
  - July 17-22, 2022 Crystal Gateway Marriott, Arlington VA

# COVID-19 Impacts reported by fellows

**Figure 4-28.** Percent of current fellows reporting the extent to which their experience in the DOE CSGF program has been impacted by modifications to in-person learning as a result of COVID-19 (N=83)



NOTE: Item only appeared on fellows survey. For the second item, 1 percent of respondents strongly agreed.

# The Take-Away

- In 2022 the DOE CSGF program is at the strongest point in its history
  - Total Funding level \$17M/year
  - 33 Fellows selected for 2022
  - Diversity of cohorts – all under-represented groups participate in the fellowship
- 66 Alumni employed at DOE National Laboratories
- Longitudinal study based on survey of 56% of CSGF alumni and fellows shows high satisfaction and impact of the fellowship

