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THE INTERNATIONAL SOCIETY
FOR OPTICS AND PHOTONICS

OPTICS & PHOTONICS GLOBAL SALARY REPORT 2022



Introduction

The Optics and Photonics Global Salary Report provides a reference for employees, students, and managers interested in understanding compensation across the career landscape: How does my pay compare with that of my colleagues? How has the COVID-19 pandemic affected remote versus in-person work in our community? What can I expect to earn in industry versus academia? The report addresses these questions and a variety of other issues across fourteen topical sections, drawing on original research conducted by SPIE.

SPIE delivers the report each year, free of charge, as part of its mission as a not-for-profit educational society supporting the science and application of light. The report builds on data from over 3,800 individuals in 90 countries¹ who shared career information in a short online survey. This is the twelfth annual survey and report, the largest such study in the optics and photonics community.

Unless otherwise noted, all results are based on full-time workers. For a complete list of participant countries and other details on survey methodology, please see [Methodology and Endnotes](#) on page 23.



**“CONSTANTLY LEARN.
ASSUME THAT IN 10 YEARS
YOU NEED TO REPLACE
EVERYTHING YOU LEARNED IN SCHOOL
WITH NEW COMPETENCIES”**

Photo credit: Getty Images, Richard Newstead

Key findings:

- The median salary for all full-time employees declined 1%, from \$79,380 last year to \$78,644 this year.²
- Many workers shifted to remote work early in the pandemic, but have started to return to face-to-face workplaces over recent months.
- Salaries paid in Chinese yuan are up 21% versus last year, and have increased 178% since 2011. Since last year, earnings in British pounds rose by 21%, while pay in U.S. dollars was flat. Earnings in euro and Japanese yen each declined 2%.
- The highest-paid discipline is aerospace, with a median income of \$116,273. Aerospace has held the top spot for all twelve years that the survey has been conducted.
- Median salaries are 16% higher overall for men than for women, down from 28% in last year's survey.
- Most full-time workers surveyed identify as engineers (64%). Within this group, 59% have engineering degrees and are working as engineers, 25% have engineering degrees but are not working as engineers, and 16% work as engineers without having engineering degrees.
- The most popular engineering degrees are electrical (27%) and optical (19%), with mechanical (13%) falling in third place.
- The largest proportion of engineers focus their work on optical engineering (41%), followed by electrical (11%).
- Startups account for just over 15% of workers at for-profit organizations. These workers earn median salaries of \$85,000, versus \$107,000 for those at traditional companies.
- Almost two-thirds of student respondents are working towards a PhD (64%), followed by 22% pursuing master's degrees, and 11% seeking a bachelor's degree.

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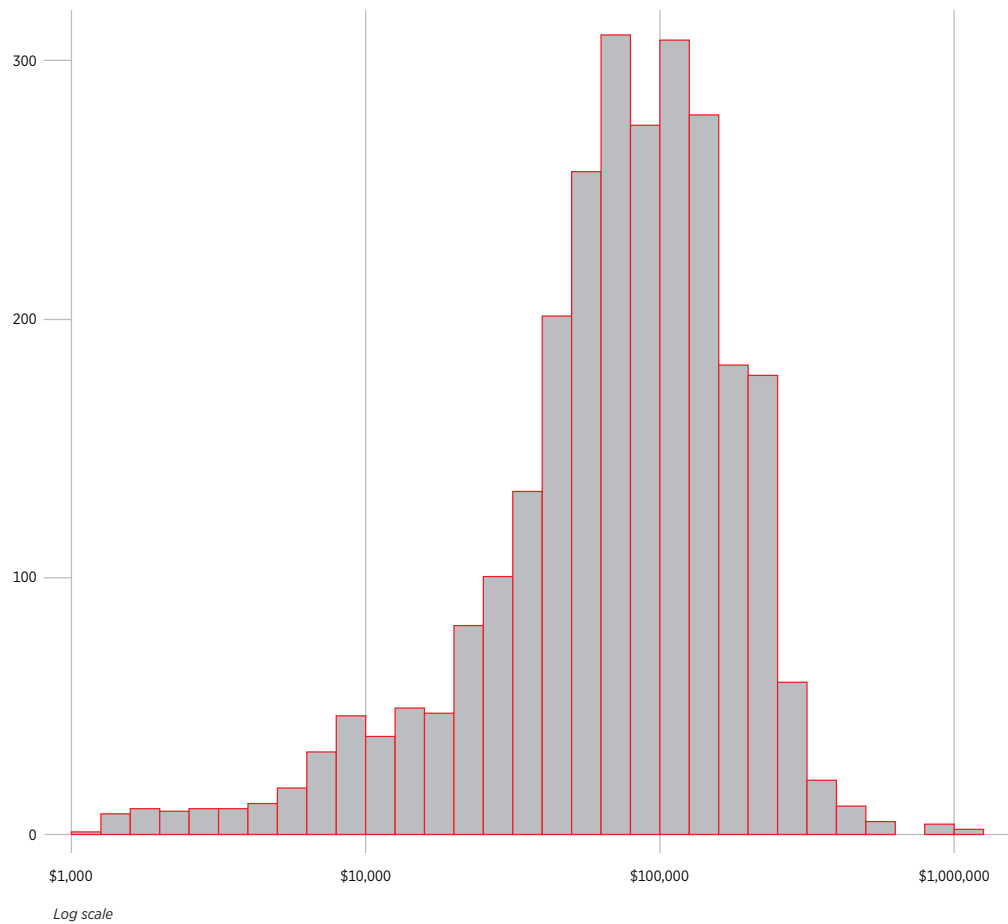


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Distribution of Full-time Salaries

Full-time salaries cluster around the median of \$78,664, with half of respondents being paid between \$44,042 and \$134,000. The overall distribution of pay is very wide, with 5th percentile workers earning \$9,204 while those at the 95th percentile earn \$245,000.



Data Overview

Full-time Salary Summary Statistics

- Mean = \$101,864
- Median = \$78,644
- 5th percentile = \$9,204
- 25th percentile = \$44,042
- 75th percentile = \$134,000
- 95th percentile = \$245,000
- 99th percentile = \$370,000
- $n = 2,698$

Response Demographics

- 3,808 Valid responses
- 2,698 Full-time employees
- 150 Part-time employees
- 89 Unemployed
- 75 Retired
- 2,861 Men
- 764 Women
- 796 Students

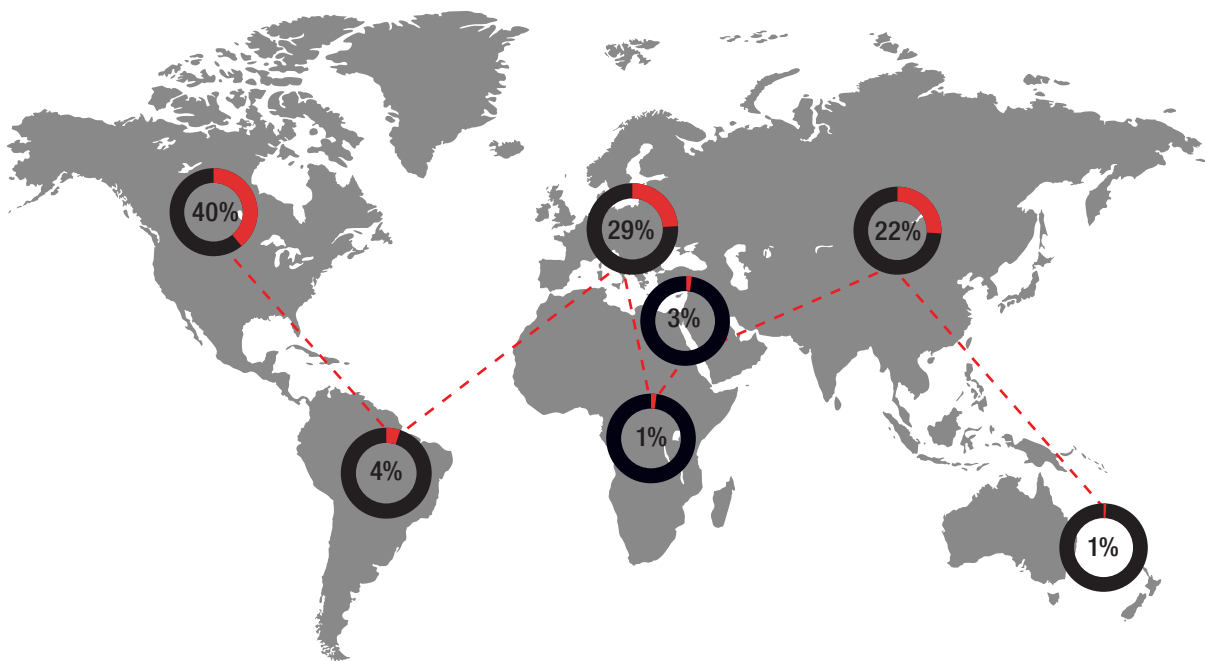
Country Overview

Workers in Switzerland, the United States, and Israel enjoy the highest median salaries. Workers at for-profit organizations earn more than their colleagues in academia in most of the countries listed.

Median salary for full-time workers, overall and at for-profit and academic employers

Country	All	For-profit	Academic
Switzerland (n=35)	\$131,052	\$131,052	\$99,381
United States (n=1155)	\$130,000	\$145,000	\$104,500
Israel (n=18)	\$119,783	\$129,495	
Netherlands (n=38)	\$99,377	\$116,881*	\$58,723
Australia (n=23)	\$83,274	\$81,463	\$85,576
Germany (n=137)	\$79,050	\$95,989	\$67,757
Canada (n=74)	\$78,725	\$77,150	\$66,522
Japan (n=112)	\$77,496	\$75,120	\$77,496
Chile (n=12)	\$71,959		\$70,779*
South Korea (n=47)	\$71,017	\$81,775	\$63,916*
Singapore (n=22)	\$68,234	\$68,234	
Austria (n=11)	\$67,757		\$67,757*
United Kingdom (n=84)	\$67,034	\$71,774*	\$66,357
Finland (n=12)	\$66,628	\$86,955	
Sweden (n=10)	\$62,503	\$80,316	\$46,209
Taiwan (n=34)	\$58,101	\$76,258	\$63,548
France (n=64)	\$52,598	\$62,110	\$42,800
Italy (n=117)	\$47,430	\$56,464	\$40,654
Czechia (n=18)	\$44,874	\$42,928	\$44,874
Lithuania (n=15)	\$44,042	\$44,607*	
Portugal (n=17)	\$40,654		\$53,754
Spain (n=69)	\$40,654	\$49,858	\$40,654
Peoples Republic of China (n=116)	\$39,282	\$62,851	\$31,425
Greece (n=10)	\$30,491		\$29,361*
Brazil (n=27)	\$26,418	\$10,567*	\$26,312
Mexico (n=23)	\$23,411	\$9,267	\$27,313
Poland (n=24)	\$21,033	\$32,415*	\$17,587
Argentina (n=12)	\$19,403		
India (n=91)	\$16,102	\$14,090	\$13,419
Russia (n=84)	\$15,033	\$26,608	\$12,639
Turkey (n=31)	\$9,204	\$18,069*	\$8,496
Pakistan (n=11)	\$8,490		\$8,490
Ukraine (n=13)	\$6,992		\$4,006
Table includes all countries with a sample size of 10 or more full-time workers. Minimum cell sample size is 5 respondents, with an asterisk indicating sample size of 5-9. The "All" column shows median salary for all full-time workers. The for-profit and academic columns represent the subsets within those types of organizations.			

Survey responses by region



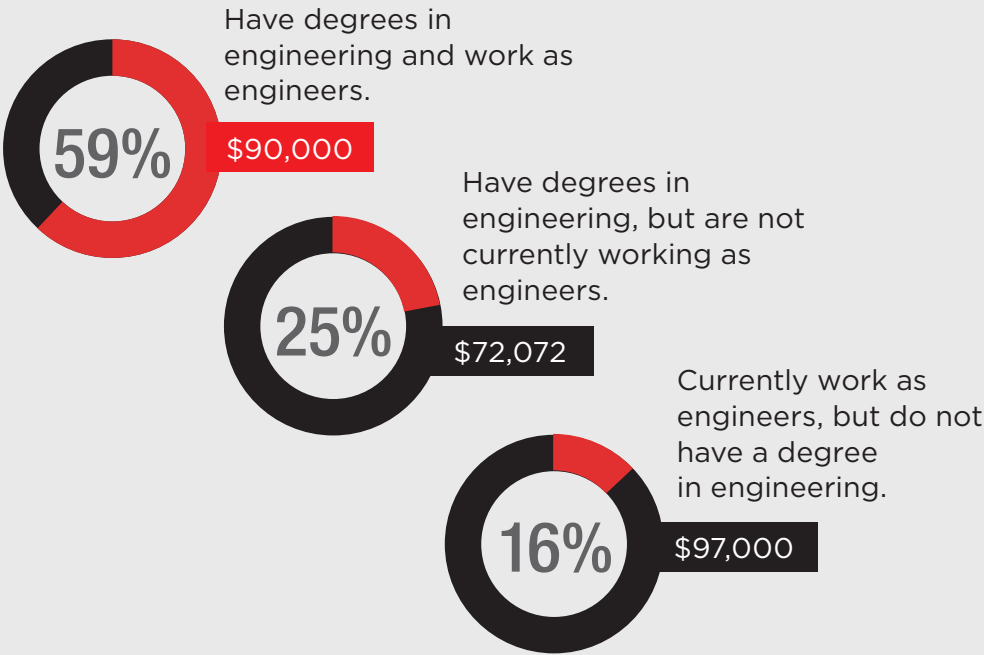
“GET AS HIGHLY QUALIFIED
AS YOU CAN,
THEN YOU MIGHT
BE OF SOME USE TO THE
GLOBAL COMMUNITY!”

Photo credit: Shutterstock, Marina Grigorivna

Engineers in Optics and Photonics

64% of full-time workers identify themselves as engineers

Within this group:

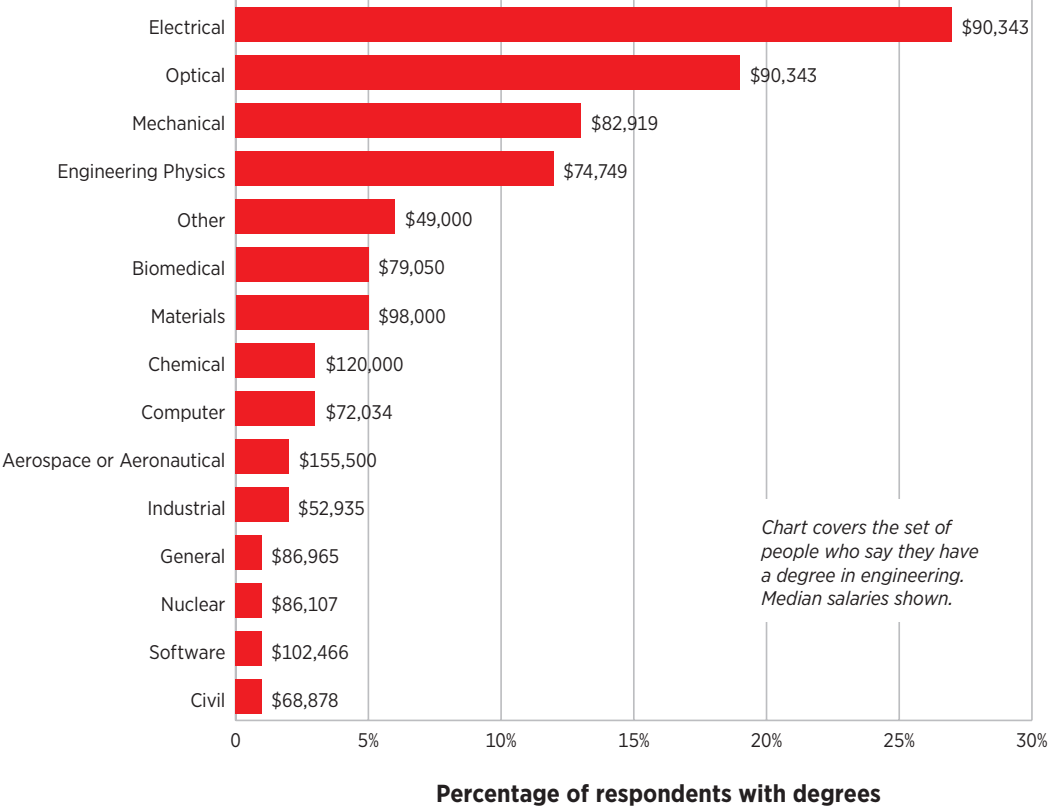


-Median salaries shown.

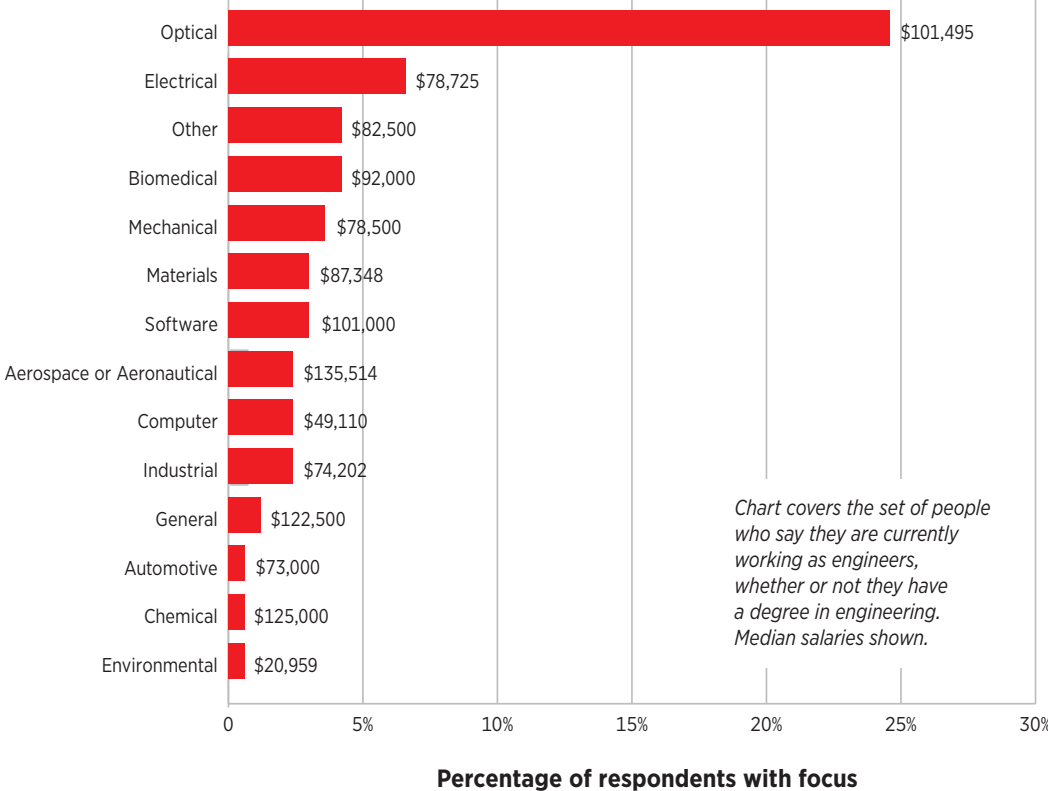


Photo credit: Shutterstock, lightpoet

What type of engineering degree do you have?



What type of engineering is your main focus?



Remote Work

The COVID-19 pandemic has created a shift to remote work in our community. Prior to the pandemic, only 11% of survey respondents worked half or more of their hours remotely. One year ago, 64% of employees worked remotely half or more of the time, while currently that number has declined to 45%.

What proportion of your work hours did or do you spend working remotely versus in an office, lab, or other workplace with colleagues?

	100% Remote	Mostly Remote	About Half and Half	Mostly Workplace	100% Workplace
Pre-Covid Pandemic	3%	3%	5%	27%	62%
One year ago	21%	25%	18%	21%	15%
Currently	10%	16%	19%	29%	26%

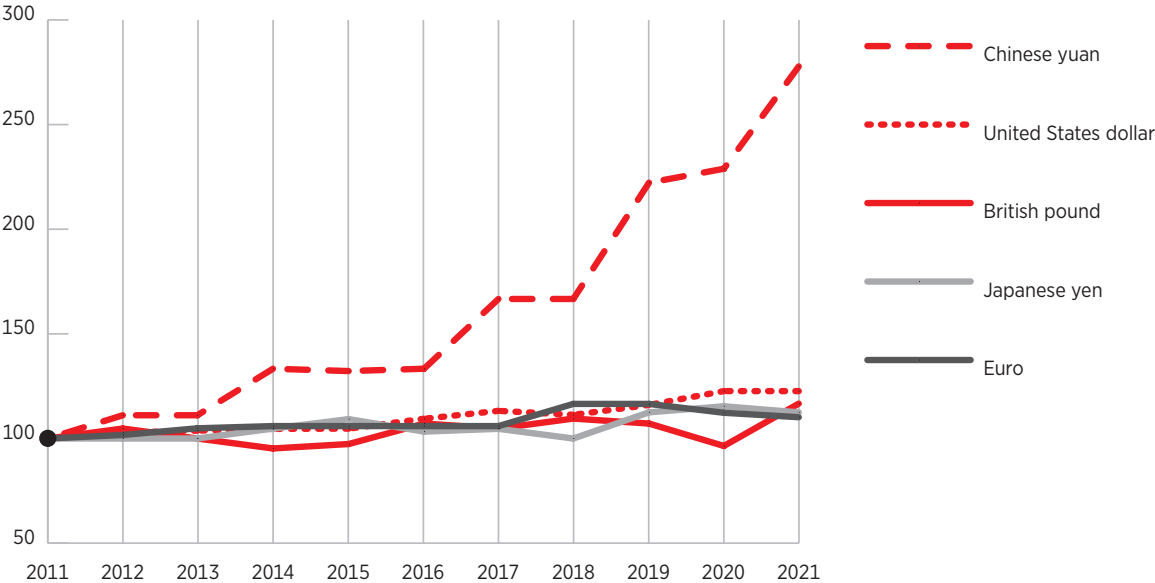


Photo credit: Shutterstock, fizkes

Wage Growth

Salaries paid in Chinese yuan and British pounds are both up 21% versus last year. Pay in U.S. dollars was flat, while earnings in euro and Japanese yen each declined 2%. Although overall median salary declined by one percent this year, over the twelve years that this survey has been conducted, median salaries in each of these five currency groups have increased. Wages paid in Chinese yuan have increased the most, rising 178% since 2011.³

Change in median salaries, 2011-21, main currency groups



Growth in median salaries, 2011-2021, main currency groups

	2011 Median Salary	2020 Median Salary	2021 Median Salary	Growth 2020-2021	Growth 2011-2021
Chinese yuan	¥90,000	¥206,000	¥250,000	21%	178%
United States dollar	\$106,000	\$130,000	\$130,000	0%	23%
British pound	£42,000	£40,050	£49,000	21%	17%
Japanese yen	¥8,000,000	¥9,230,000	¥9,000,000	-2%	13%
Euro	€47,200	€53,000	€52,000	-2%	10%

“A career in
OPTICS/PHOTONICS
is exciting, fun and profitable!”

Career Stage

For the set of countries included below, pay for full-time workers is highest in the United States and North America at every career stage, while employees at for-profit organizations earn more than their counterparts in academia.

Median salary by years employed for selected countries

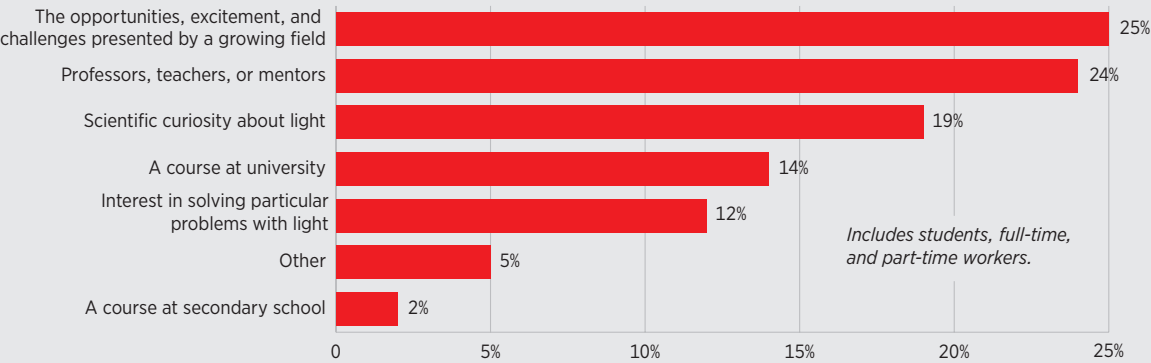
	Italy	France	Germany	United Kingdom	Japan	Canada	United States
Less than one year			\$54,206*			\$56,682*	\$73,500
1-2 years	\$25,974*	\$40,654*	\$66,628			\$43,298*	\$70,000
3-5 years	\$40,338	\$43,929	\$63,804	\$53,492	\$47,359*	\$66,916*	\$92,000
6-10 years	\$37,266	\$46,865*	\$79,050	\$58,232	\$59,019	\$76,756	\$119,000
11-15 years	\$43,477	\$58,610*	\$95,424	\$67,711	\$70,608	\$74,788*	\$130,000
16-20 years	\$47,430	\$67,757	\$107,959		\$81,801	\$90,533*	\$142,500
21-25 years	\$56,464	\$74,533*	\$102,482		\$88,259	\$110,214*	\$165,688
26-30 years	\$62,110*		\$112,928*	\$96,827*	\$86,107		\$164,350
More than 30 years	\$73,403	\$73,403*	\$90,343*	\$103,598	\$103,328	\$118,087	\$172,500

Blank cells result from sample size below 5 respondents. An asterisk indicates sample size of 5-9.

Median salary by years employed and organization type category

	Academic	Government/military	For-profit
Less than one year	\$44,708	\$53,076	\$54,353
1-2 years	\$48,559	\$39,299	\$57,699
3-5 years	\$48,220	\$65,051	\$79,911
6-10 years	\$53,608	\$66,695	\$84,696
11-15 years	\$51,953	\$53,386	\$94,136
16-20 years	\$59,174	\$72,144	\$114,622
21-25 years	\$81,801	\$90,343	\$132,366
26-30 years	\$89,293	\$140,000	\$143,000
More than 30 years	\$105,000	\$90,343	\$148,468

What most inspired you to pursue optics, photonics, or a related field?



Median salary by years employed and region

	Europe, Lower Income	Asia, Lower Income	Latin America & Caribbean	Middle East	Europe, Higher Income	Asia, Higher Income	North America
Less than one year		\$22,812	\$6,340*		\$37,918	\$25,018	\$70,000
1-2 years		\$10,982	\$9,754*	\$12,685*	\$39,525	\$51,664*	\$68,500
3-5 years	\$29,268*	\$20,128	\$11,521*	\$11,062	\$52,759	\$47,359	\$88,071
6-10 years	\$12,865	\$21,500	\$21,877	\$20,281	\$54,169	\$58,749	\$116,000
11-15 years	\$12,725	\$28,475	\$30,851	\$22,125*	\$56,464	\$71,017	\$127,980
16-20 years	\$12,876	\$31,869	\$35,224	\$111,496*	\$61,998	\$81,473	\$140,000
21-25 years	\$15,012	\$33,006	\$24,254*	\$9,233*	\$82,040	\$83,550	\$162,000
26-30 years		\$42,940*	\$51,824*	\$67,212*	\$97,424	\$86,107	\$162,600
More than 30 years	\$17,322	\$36,901	\$54,075		\$88,731	\$108,615	\$170,000

Blank cells result from sample size below 5 respondents. An asterisk indicates sample size of 5-9.



Photo credit: Getty Images, Monty Rakusen

I WAS INSPIRED TO PURSUE OPTICS, PHOTONICS,
OR A RELATED FIELD BECAUSE:

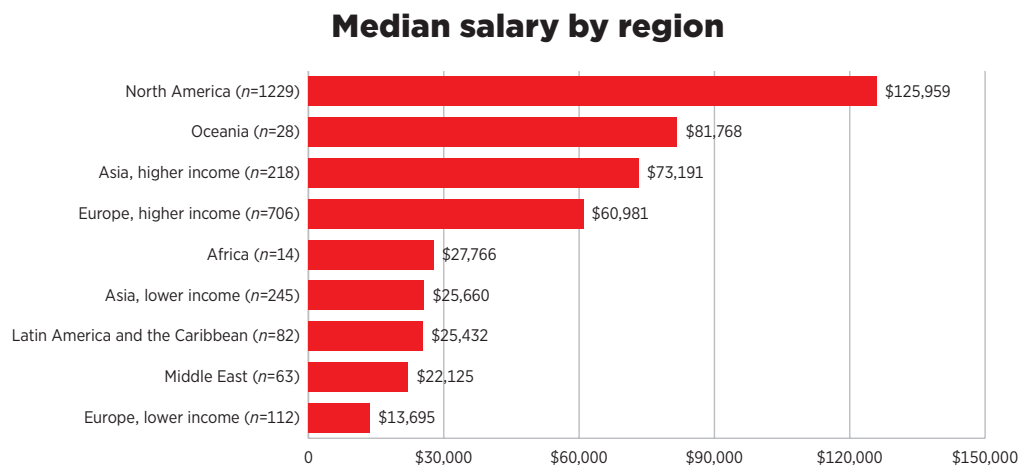
“Always had wanted to do astronomy, since age 7.”

“Great mentors in the field of optics.”

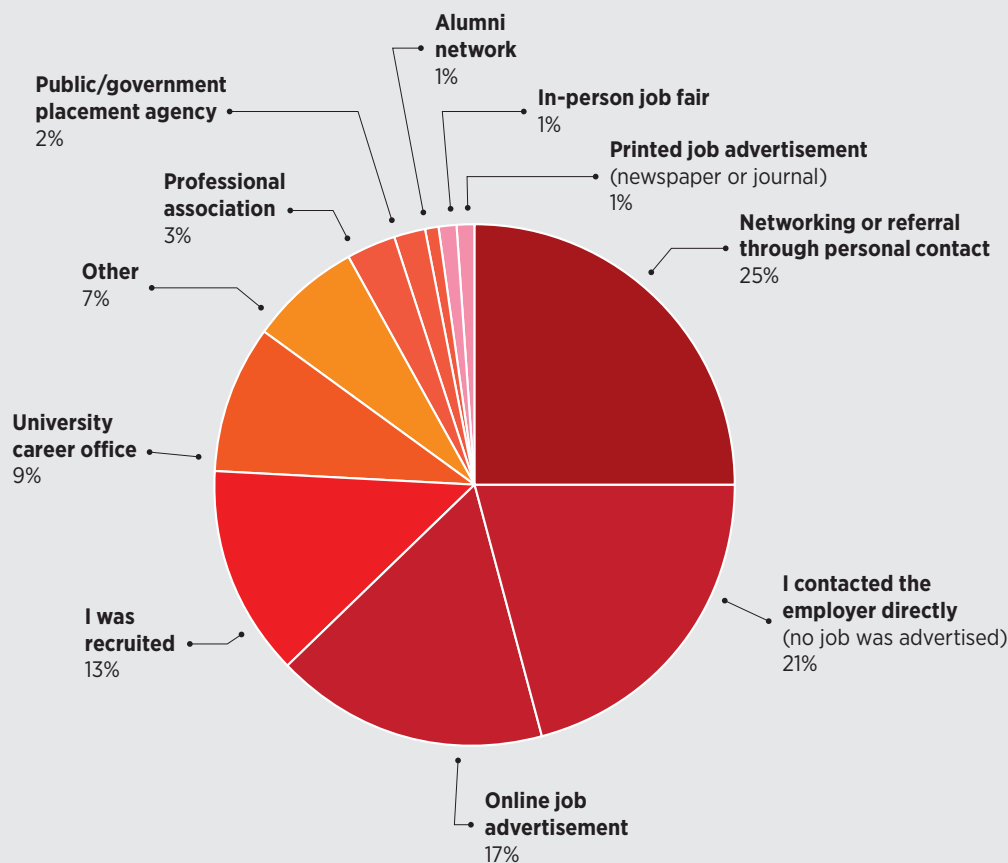
“An exciting internship in an optics lab
during my first undergrad year.”

Region

North America, Oceania, and higher-income Asia stand out as the regions with the highest salaries.⁴ A large portion of regional income gaps is explained by the level of economic development of countries within each area.⁵

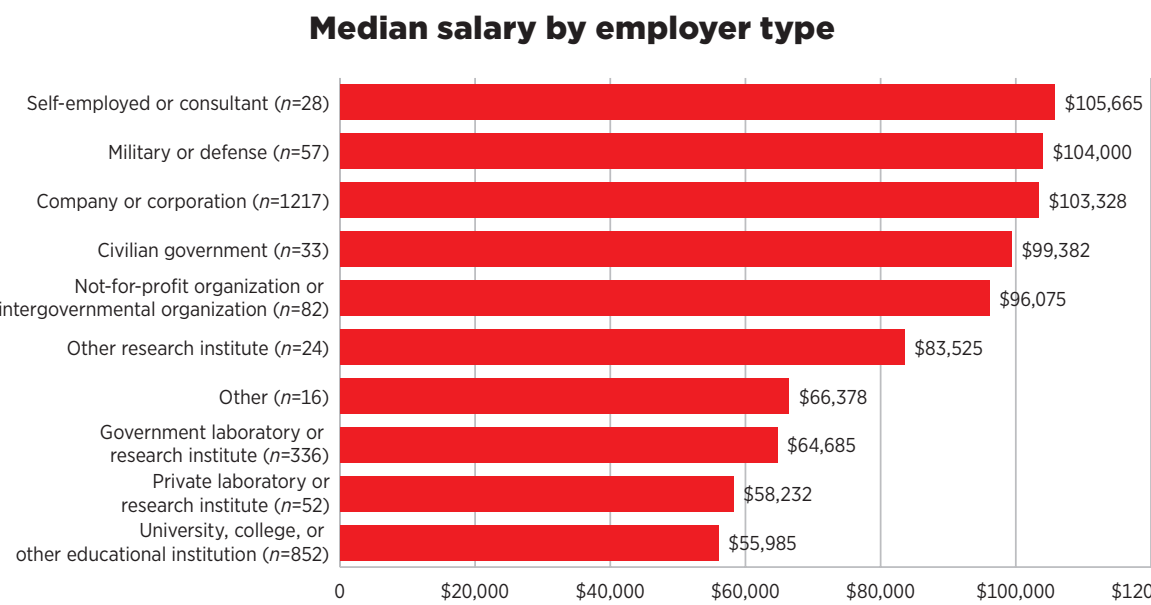


“How did you find your original position at your present employer?”



Employer Type

Median salaries are greatest for self-employed/consultants, military/defense, and for-profit companies. Universities, colleges, and other educational institutions and “private laboratory or research institute” pay the least.⁶



**Median salary by region:
For-profit, government/military, and academic employers**

Region	For-profit	Government/ military	Academic
North America	\$140,000	\$125,250	\$100,000
Asia, higher income	\$76,258	\$55,100	\$68,024
Middle East	\$75,000	\$20,097	\$8,673
Europe, higher income	\$73,403	\$55,335	\$52,480
Asia, lower income	\$31,425	\$23,483	\$23,569
Europe, lower income	\$23,947	\$14,401	\$11,604
Latin America & Caribbean	\$10,567	\$24,254	\$28,601

Startups account for just over 15% of workers at for-profit organizations. These entrepreneurs earn median salaries of \$85,000 versus \$107,000 for their colleagues at traditional companies.

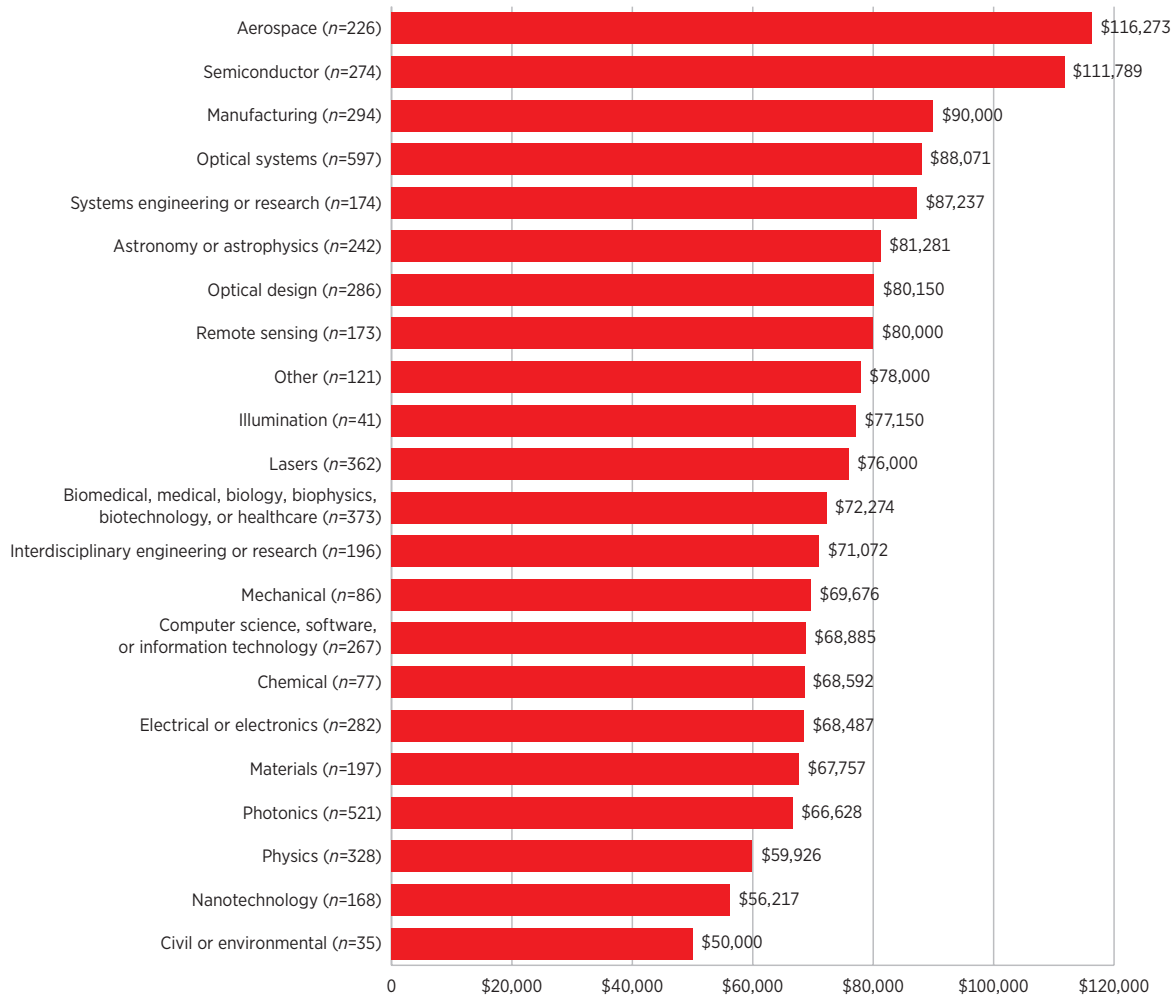
Median salaries at startup versus traditional companies

	Percentage of Respondents	Median Salary
Traditional companies	85%	\$107,000
Startup companies	15%	\$85,000
The question was seen only by respondents indicating “Company or corporation” or “Private laboratory or research institute” for organization type.		

Discipline

Aerospace and semiconductor disciplines enjoy the highest median earnings, at \$116,273 and \$111,789, respectively. Civil or environmental salaries are the smallest, with a median salary of \$50,000.

Median salary by primary discipline



The two most important factors driving salary gaps across disciplines are employment sector and country income level. The highest-paying disciplines have much higher representation at for-profit companies: 69% of semiconductor and 65% of aerospace workers are at for-profits.

Country income level has a similar impact on median salaries of optics and photonics disciplines. In aerospace, for example, 89% of workers are located in North America or higher-income European countries.

**Median salary by discipline:
For-profit, government/military, and academic employers**

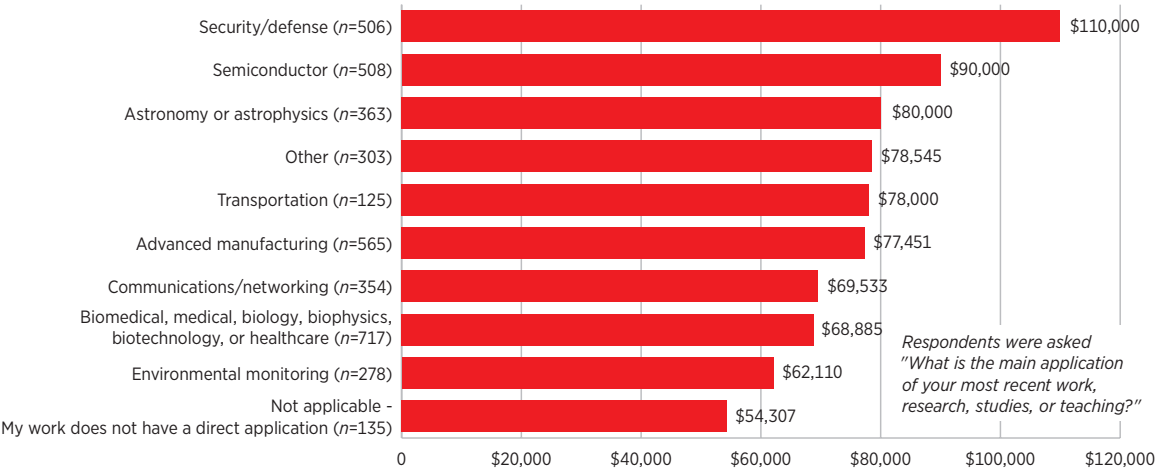
Discipline	For-profit	Government military	Academic
Semiconductor	\$135,000	\$62,110	\$55,335
Systems engineering or research	\$125,900	\$74,788	\$65,205
Aerospace	\$120,000	\$108,139	\$123,500
Physics	\$120,000	\$54,752	\$54,075
Interdisciplinary engineering or research	\$112,928	\$45,171	\$56,000
Optical systems	\$112,928	\$90,042	\$58,000
Materials	\$110,000	\$61,885	\$50,106
Electrical or electronics	\$108,940	\$62,110	\$47,284
Photonics	\$106,958	\$45,171	\$51,000
Remote sensing	\$103,328	\$87,700	\$49,159
Biomedical, medical, biology, biophysics, biotechnology, or healthcare	\$100,000	\$45,481	\$60,470
Optical design	\$100,000	\$62,110	\$58,000
Lasers	\$99,124	\$70,659	\$50,462
Nanotechnology	\$98,289	\$53,247	\$47,138
Astronomy or astrophysics	\$98,176	\$75,195	\$85,000
Computer science, software, or information technology	\$96,562	\$71,583	\$47,071
Manufacturing	\$95,000	\$74,555	\$51,461
Chemical	\$94,375	\$39,299*	\$54,750
Illumination	\$82,416	\$9,393*	\$48,827*
Other	\$79,050	\$63,896	\$73,403
Mechanical	\$77,000	\$56,774	\$63,261
Civil or environmental	\$51,827		\$50,000
The blank cell results from a sample size below 5 respondents. An asterisk indicates sample size of 5-9.			

**“OPTICAL ENGINEERING IS
A VERY FULFILLING CAREER CHOICE.”**

Application Area

Security/defense is the highest-paid application area, which is unsurprising given that 54% of these workers are in aerospace, the highest-paying discipline.

Median salary by application area

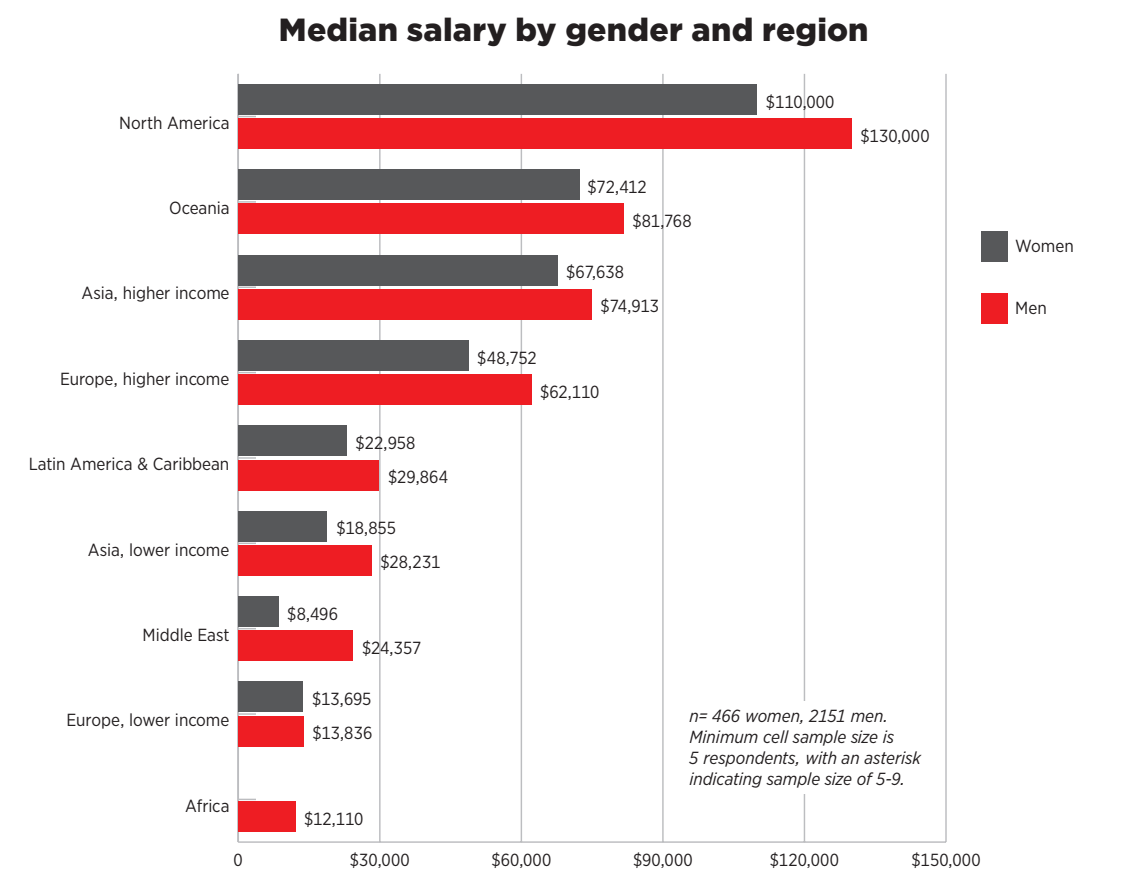


“PHOTONICS
IS A FAST-DEVELOPING FIELD
AND I LOVE BEING A PART OF IT.”

Photo credit: Getty Images - Yalax

Gender

Women make up 21% of the respondents to the survey, 31% of students, 18% of fulltime workers, and 22% of part-time workers. The median salary for all full-time women is \$68,000, versus \$79,497 for men.



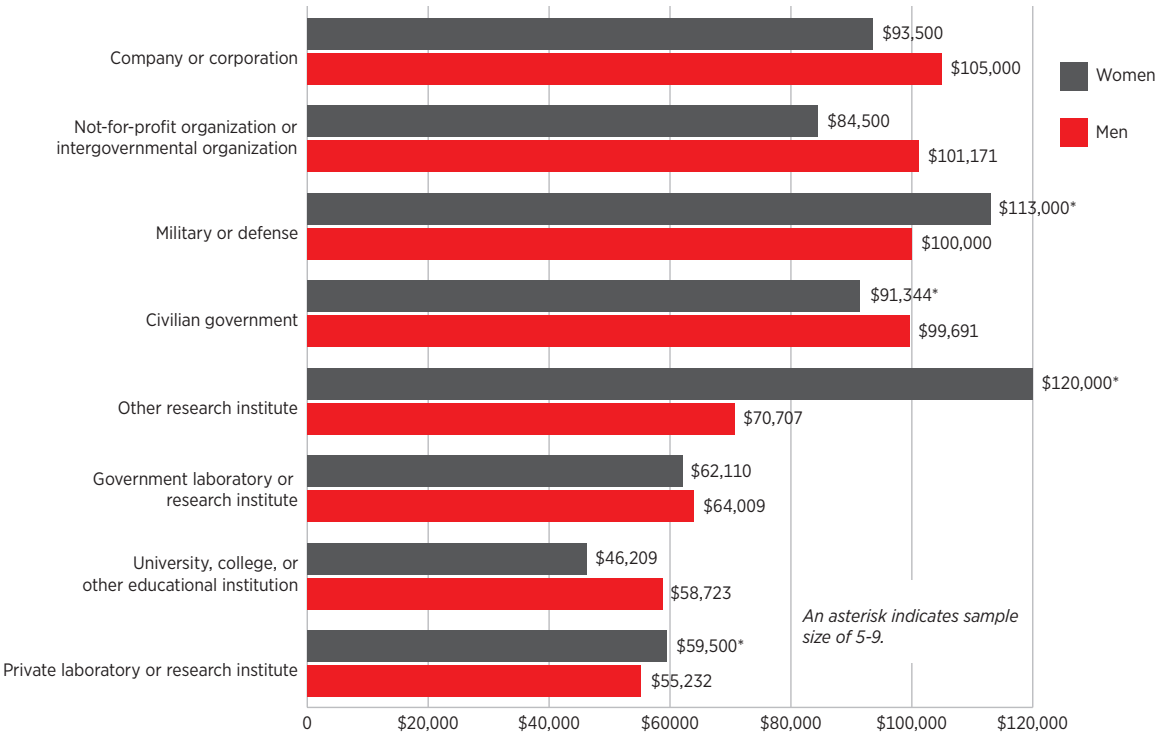
Though the overall median salary is higher for men, women earn more than men in a variety of subgroups including military/defense, civilian government, and those with 1-5 years of employment.

“THE CAREER I’M PURSUING NOW
IS A DREAM BECOMING TRUE
AND A GOAL I SET TO MYSELF YEARS AGO
THAT DESPITE MANY HARDSHIPS
I HAD ATTAINED.”

Median salary by gender and years employed

	Women	Men
Less than one year	\$50,300	\$51,000
1-2 years	\$53,250	\$49,500
3-5 years	\$67,526	\$61,866
5-10 years	\$67,711	\$67,757
11-15 years	\$48,752	\$70,743
16-20 years	\$69,788	\$79,050
21-25 years	\$94,000	\$105,000
26-30 years	\$108,940	\$120,000
More than 30 years	\$83,000	\$131,102
<i>n=458 women, 2135 men</i>		

Median salary by gender and employer type

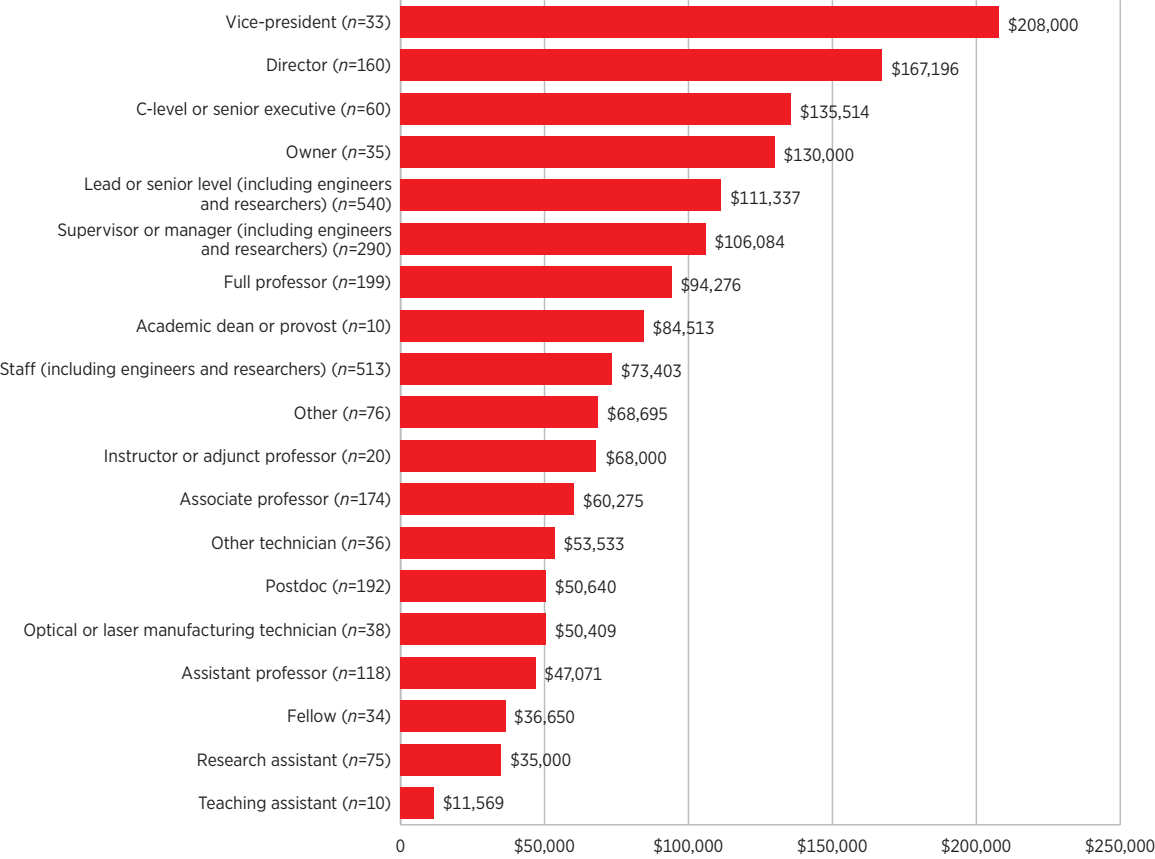


“DO IT WITH YOUR
HEART AND BRAINS
AND YOU WILL LOVE IT.
NEVER A BORING MOMENT
AND IT WILL PAY VERY WELL.”

Other Factors

Other factors that influence salary include job level and job role. Top organizational leaders enjoy the highest salaries, while research and teaching assistants anchor the bottom of the range.

Median salary by job level

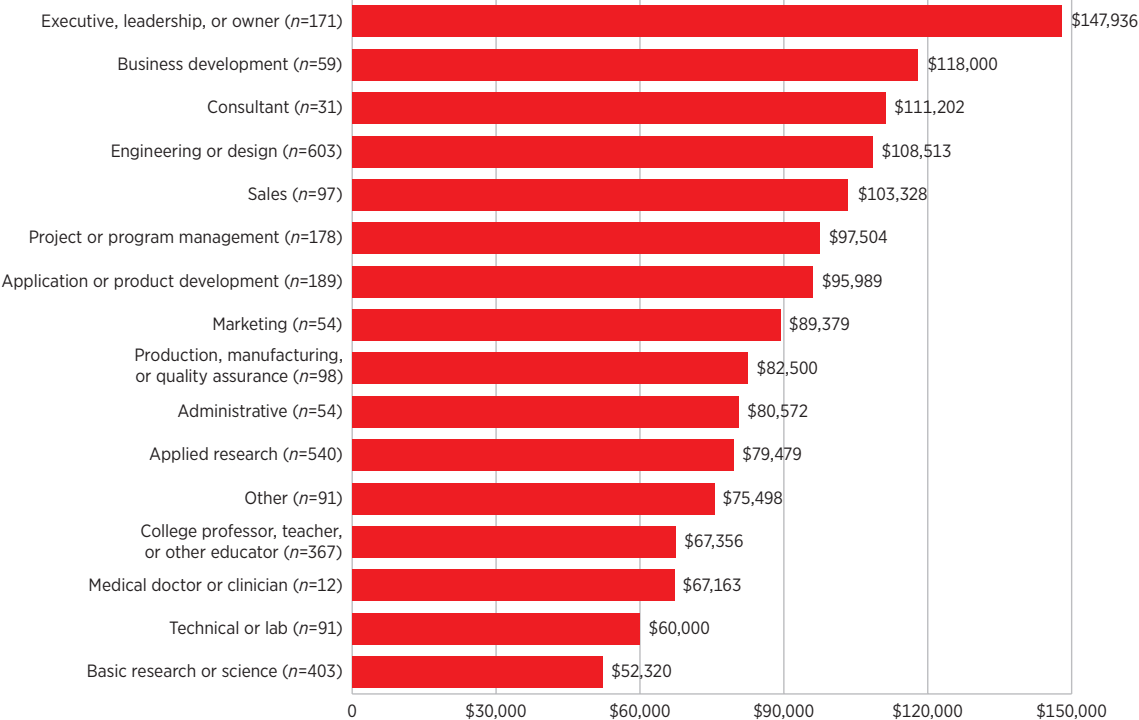


Median salary by job level, selected countries

	Staff	Lead or senior level	Supervisor or manager	Assistant professor	Associate professor	Full professor
United States	\$107,000	\$150,000	\$148,788	\$105,000	\$120,000	\$150,000
Netherlands	\$84,696*	\$116,881				
Germany	\$75,195*	\$83,550*	\$112,792*			
South Korea	\$71,032	\$95,989	\$115,187			
Canada	\$66,916	\$92,895	\$100,374			\$110,214*
France	\$53,867*	\$64,934	\$67,757		\$45,171*	
Japan	\$51,664	\$74,913	\$90,412	\$48,220*	\$67,163*	\$94,717
United Kingdom	\$48,752	\$71,636	\$60,940*		\$69,066*	\$134,068*
Italy	\$45,171	\$70,580	\$56,464	\$40,654	\$62,110	\$75,662*
Spain	\$39,525	\$62,110*		\$37,266*	\$56,464	\$92,601*
Peoples Republic of China	\$32,211	\$72,278*	\$70,707*	\$39,282*	\$31,425	\$39,282
Russia	\$11,308	\$17,960	\$19,956*		\$11,973*	\$18,625*
India	\$9,393	\$32,205*	\$14,761*	\$13,419	\$32,205*	\$33,547

Blank cells result from sample size below 5 respondents. An asterisk indicates sample size of 5-9.

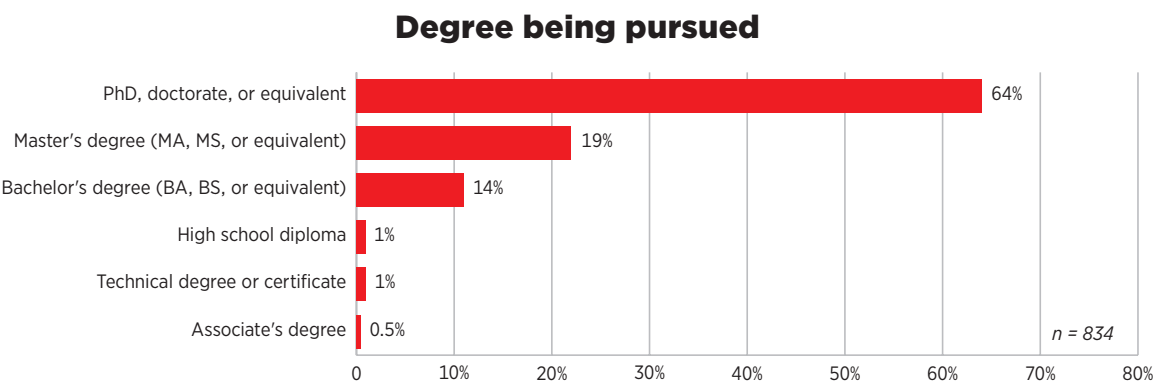
Median salary by job role



**“KEEP A BROAD PERSPECTIVE
AND STAY UP TO DATE.”**

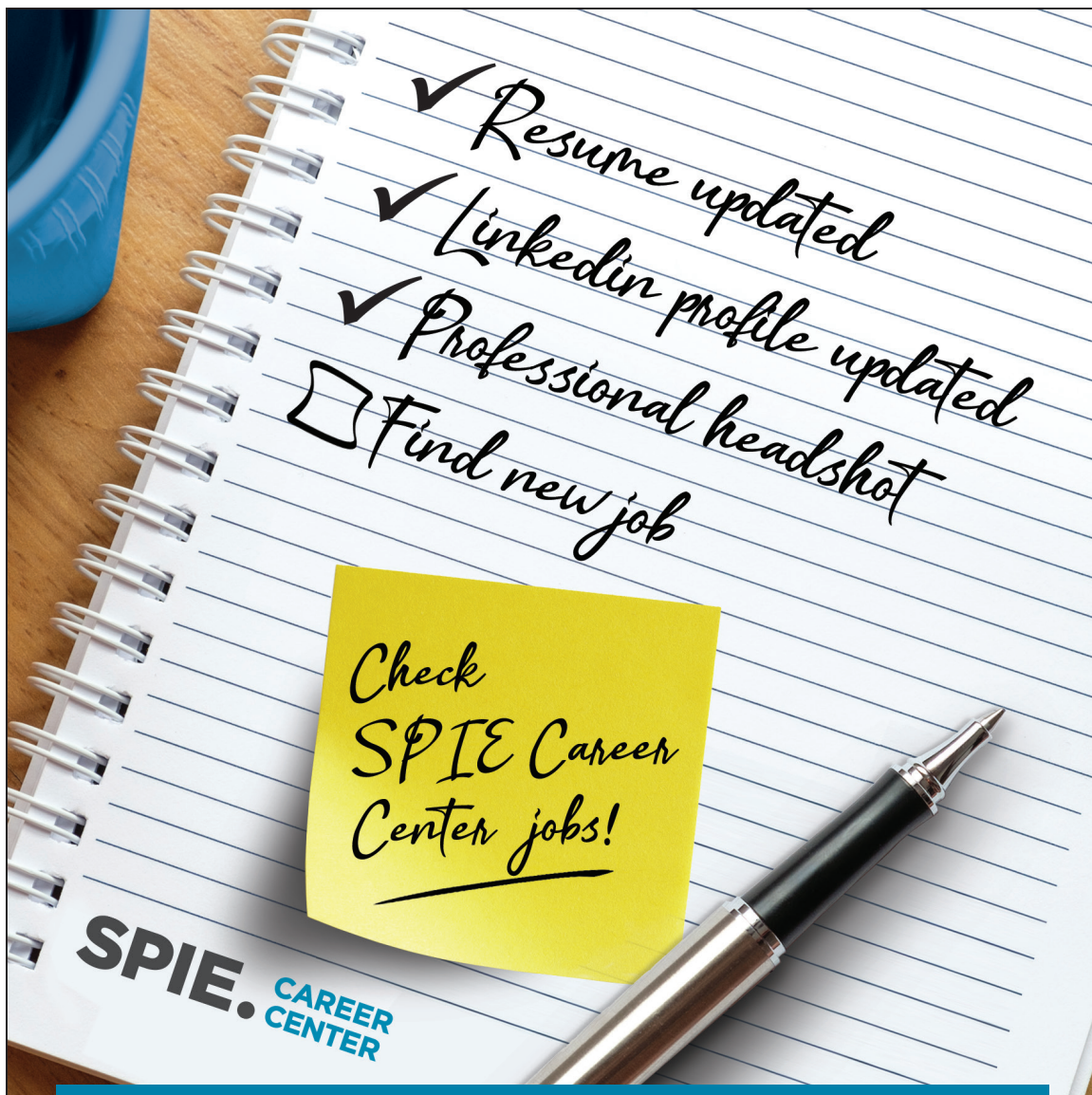
Students

The majority of student respondents are pursuing PhDs.



“STUDY A LOT AND WORK HARD.
DO NOT THINK ABOUT THE FUTURE.
ENJOY EVERY SINGLE MOMENT.”

Photo credit: Getty Images, Ted Horowitz



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Methodology and Endnotes

In December of 2021, SPIE sent email survey invitations to a large subset of its global customer database. Response was voluntary and open. A gift card raffle and early access to this report were offered as incentives to encourage participation. Surveys were completed online using Alchemer’s enterprise survey tool. Results were filtered for duplicates and invalid data to yield 3,808 valid responses. Microsoft Excel and SPSS were utilized for summary statistics and related analyses.

Notes:

1. This list includes valid responses from full-time, part-time, unemployed, student, and retiree respondents. United States (1389), India (248), Peoples Republic of China (224), Germany (185), Italy (142), Japan (130), Canada (117), Russia (111), United Kingdom (110), Spain (86), France (85), South Korea (60), Mexico and Turkey (56), Brazil and Switzerland (46), Taiwan (45), Netherlands (43), Poland (37), Australia (30), Israel (27), Czechia and Pakistan (24), Singapore (23), Austria (22), Lithuania and Portugal (20), Ukraine (18), Belgium (16), Argentina and Finland (15), Chile (14), Egypt (13), Denmark and Greece (12), Colombia and Sweden (11), Malaysia and Nigeria (10), Indonesia, Ireland, New Zealand, Romania, and South Africa (9), Algeria (8), Morocco (7), Bulgaria, Hong Kong SAR, China, and Hungary (6), Bangladesh, Latvia, Saudi Arabia, and United Arab Emirates (5), Ecuador, Iran, Philippines, Slovak Republic, and Thailand (4), Angola, Estonia, Norway, and Vietnam (3), Armenia, Cote d'Ivoire, Ethiopia, Iraq, Moldova, Peru, Slovenia, and Tunisia (2), Azerbaijan, Belarus, Bolivia, Cameroon, Chad, Croatia, Cyprus, Jordan, Kazakhstan, Kenya, Libya, Liechtenstein, Malta, Nepal, Palestine, State of, Qatar, Serbia, Suriname, Uganda, and Uzbekistan (1).
2. U.S. dollars are used throughout. Local currencies were converted using January 2022 market exchange rates. Salary figures include total yearly compensation, both base pay and bonuses. Full-time employees are those who indicated working 35 or more hours per week. Unless otherwise noted, all data on pay is drawn from full-time employees.
3. Yearly growth was computed by comparing same-currency results for each year.
4. Oceania is comprised of Australia and New Zealand. North America is comprised of the United States and Canada. Mexico is included in the Latin America and Caribbean category.
5. Europe and Asia are composed of countries spanning a wide range of income levels, even when subdivided into higher- and lower-income groups. For example, the European higher-income category includes Lithuania and Norway at \$19,620 and \$78,290 per capita Gross National Income (GNI), respectively, for 2020. European lower-income countries include Russia at \$10,690 and Ukraine at \$3,370. Higher- and lower-income subcategories are based on the World Bank's threshold for high-income countries, \$3,540 per capita GNI in 2020. This threshold is used throughout this report when referring to "higher-income" and "lower-income" countries. For data on per capita GNI, see <http://data.worldbank.org/indicator/NY.GNP.PCAP.CD/countries>. For World Bank country income categories, see <http://data.worldbank.org/about/country-classifications>.
6. The category "for-profit" is composed of company/corporation, self-employed/consultant, and fill-in "other" entries that indicate for-profit affiliation. "Academic" is composed of university/college, private lab or research institute, not-for-profit, intergovernmental, other research institute, and open-text "other" entries that indicate academic organizations. "Government/military" is composed of government lab or research institute, civilian government, and military/defense.

**“ENJOY VISIBLE,
SEARCH FOR
INVISIBLE,
AND ENJOY THE
POSITIVE RESULTS.”**

Notes

**“ HE WHO TEACHES KNOWLEDGE
TO PEOPLE
WILL NOT REGRET IT. ”**

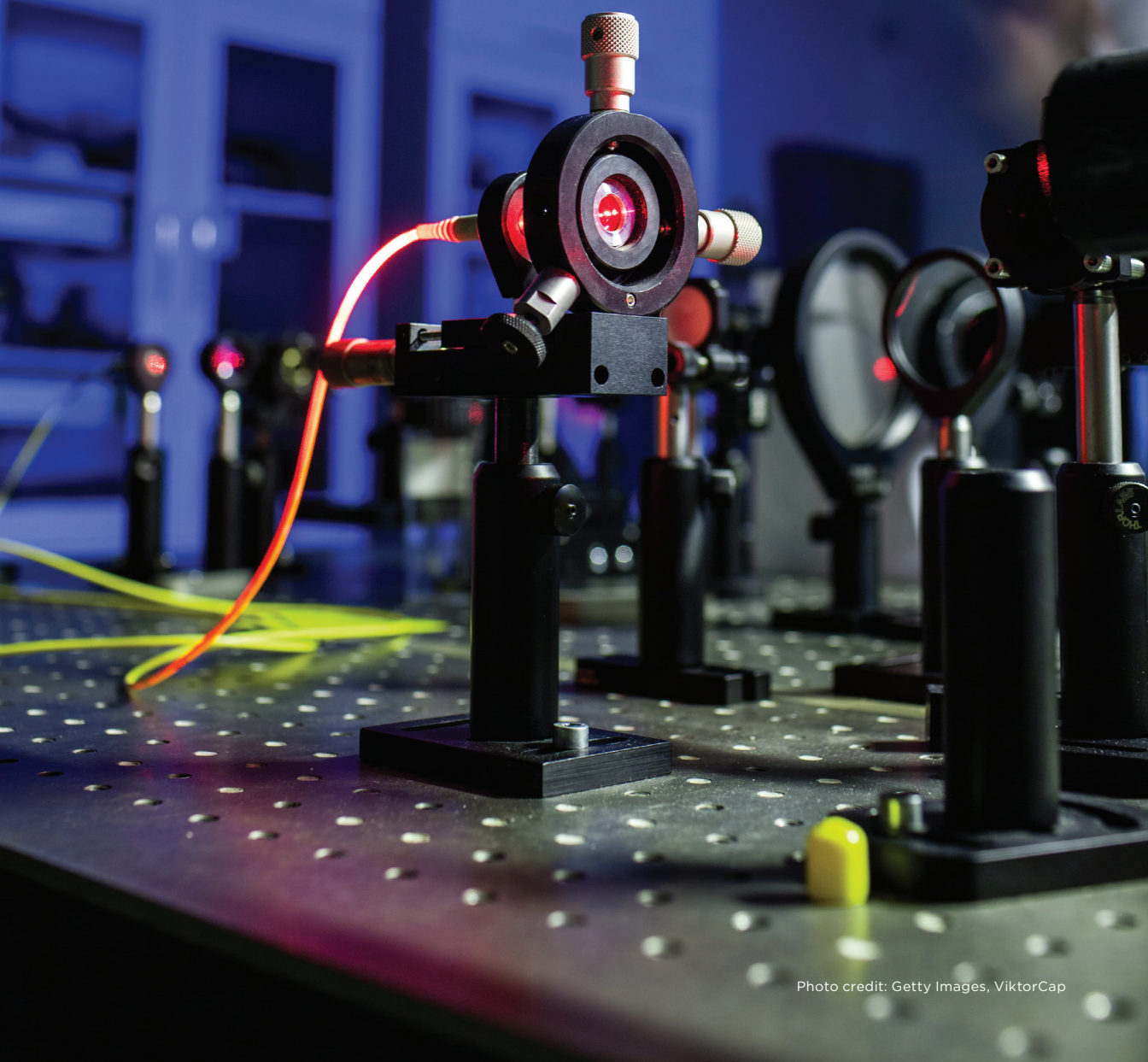


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