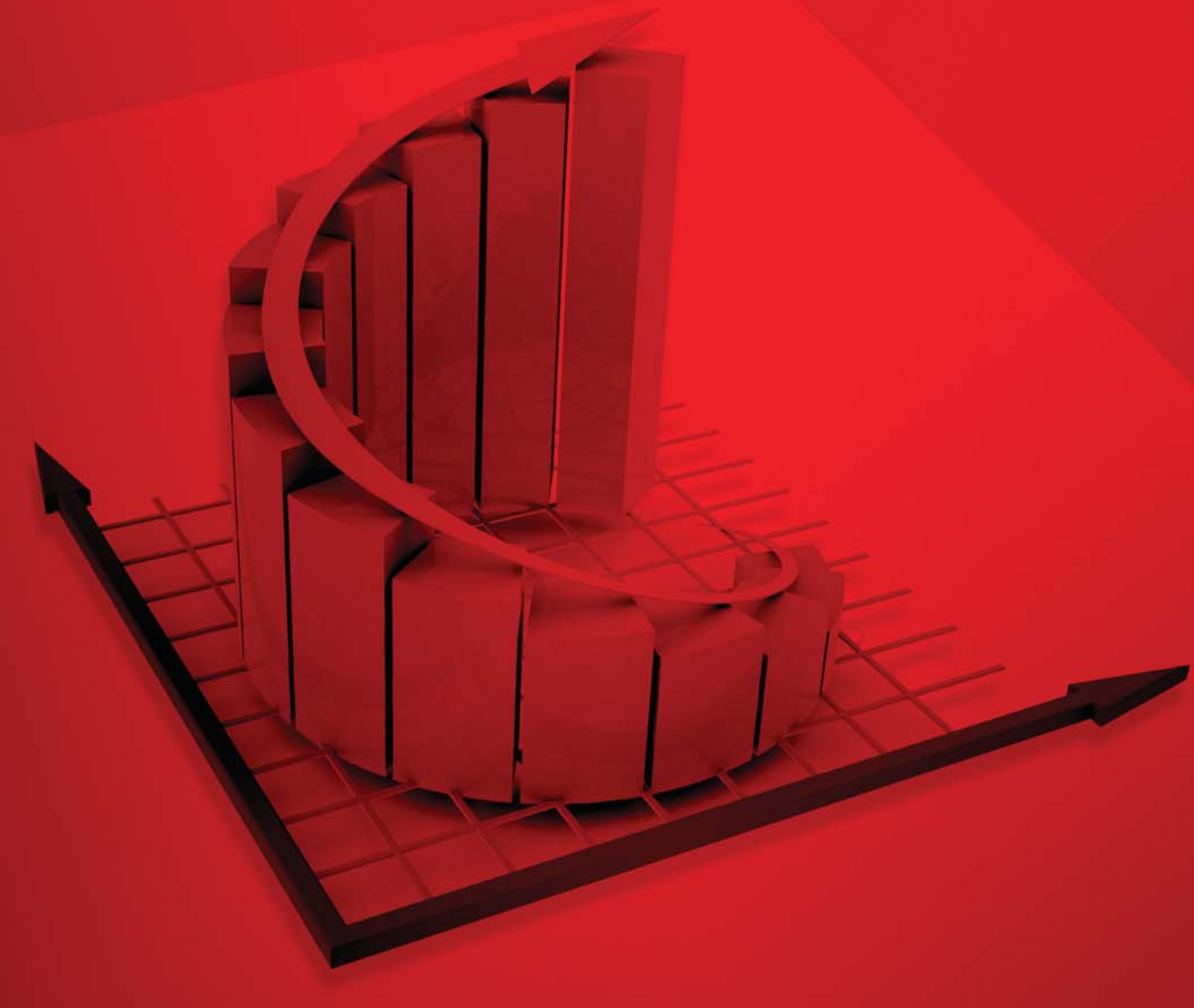
SPIE

2012 SECOND ANNUAL Optics and Photonics Global Salary Report



2012
SECOND ANNUAL

Optics and Photonics Global Salary Report

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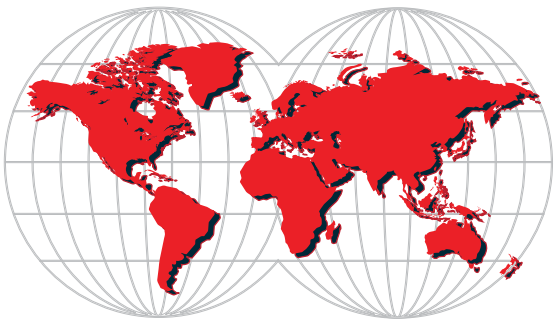

SPIE® Connecting minds Advancing light.

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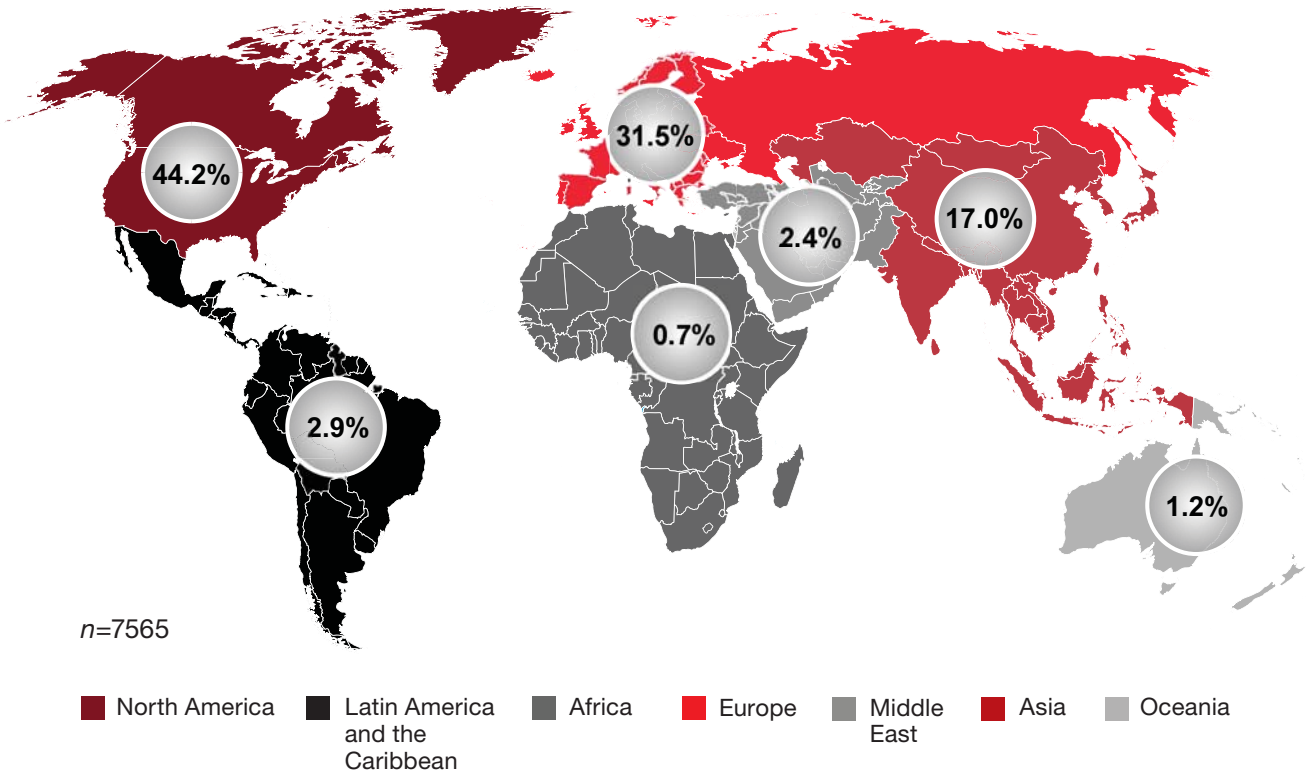
Key Findings

- The median salary for survey respondents is $73,000,[1] with a very wide distribution driven primarily by geographic region and employer type.
- The factors most associated with higher salaries are North American location and non-university employment.
- Survey respondents are highly satisfied with their jobs overall: 82% enjoy their work, while 87% find it meaningful.
- Median salaries are 37% higher for men than for women, with the largest gap at private labs and the smallest gap at civilian government employers.
- The highest-paid discipline is aerospace, with a median income of $108,500.

Survey Responses by Region



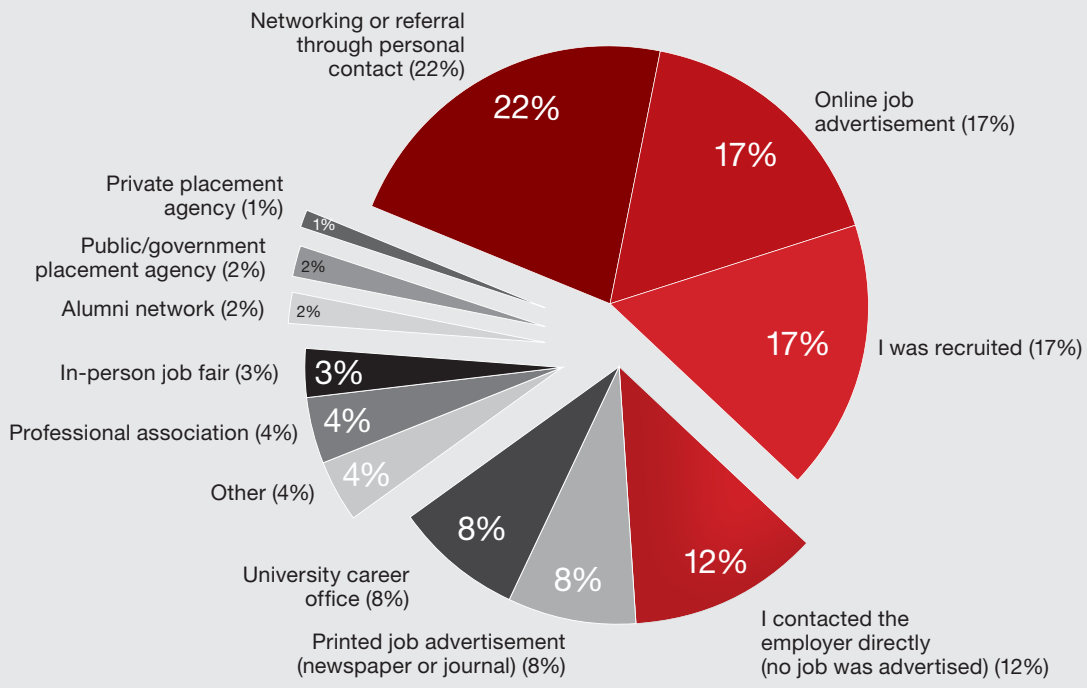
Background

SPIE conducted the survey in April and May of 2012. It is the largest survey of its kind in the global optics and photonics community, providing data on the full breadth of employment and compensation patterns across regions, disciplines, and types of organizations.

SPIE sent survey invitations via email to its global database. Over 7,500 valid responses were gathered, with 93% of participants located in North America, Europe, and Asia. Respondents from Latin America/Caribbean, the Middle East, Oceania, and Africa provided the balance of data.

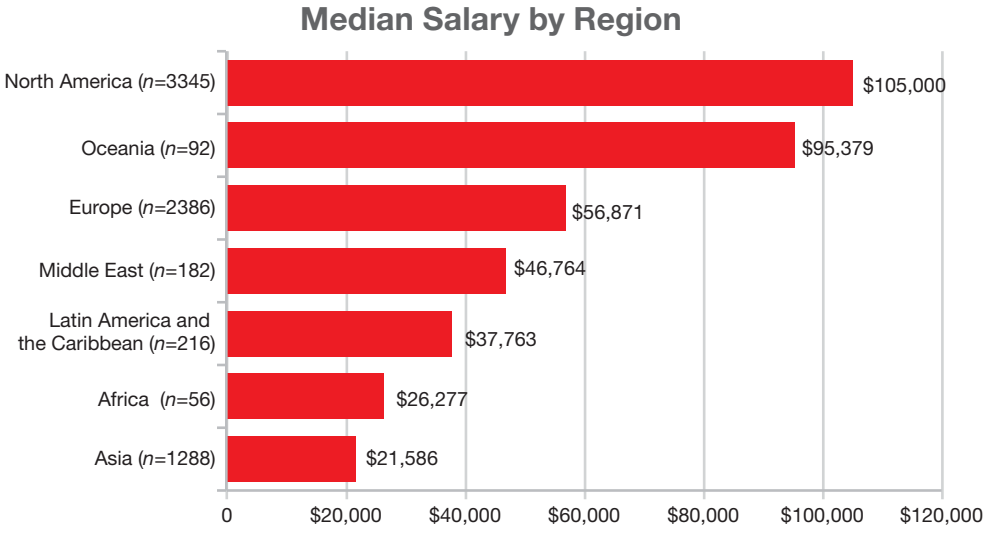
The size and diversity of the sample has increased since last year, with the participant pool up 10% and the number of countries growing from 93 to 101.[2] An examination of job satisfaction has been added to the traditional categories of geographic region, professional focus, gender, and employer type. Results for 2012 are generally consistent with 2011, with most regions and countries showing minimal change in median salaries. For complete survey methodology, please see page 15.

How Did You Find Your Current Position?

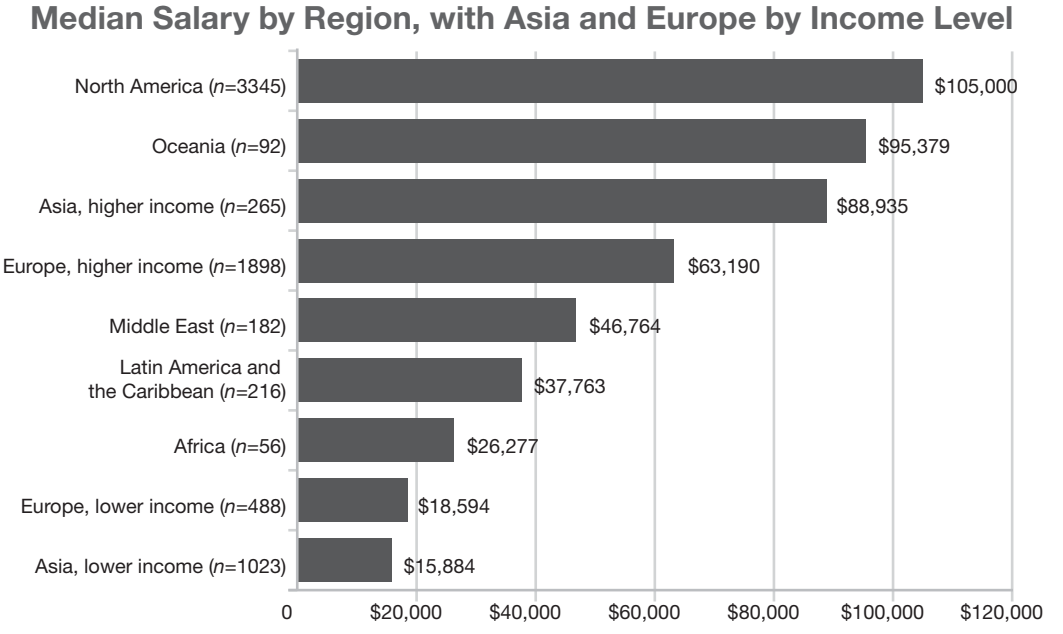


Region

North America and Oceania (Australia/New Zealand) stand out as the regions with the highest salaries, with median earnings well above those of all other areas. North American median incomes are 85% higher than Europe, almost triple those of Latin America/Caribbean, and about five times greater than Asia's.



A large portion of regional income gaps is explained by the level of economic development of countries within each region. Separating European and Asian countries into "higher-income" and "lower-income"[3] subcategories narrows the gap between North America/Oceania and higher-income subsets of Asian and European countries. Asia's wealthier countries' median income is 18% below North America's, with Europe at 66% below.



When broken down on a country-by-country level, the results are unsurprising—countries from the highest-earning regional groups dominate the top of the list, while lower-income countries are clustered at the bottom. There is, however, a high degree of diversity within regional groups. For instance, high-income European countries range from Spain at a median salary of $45,477 to Switzerland at $120,186.

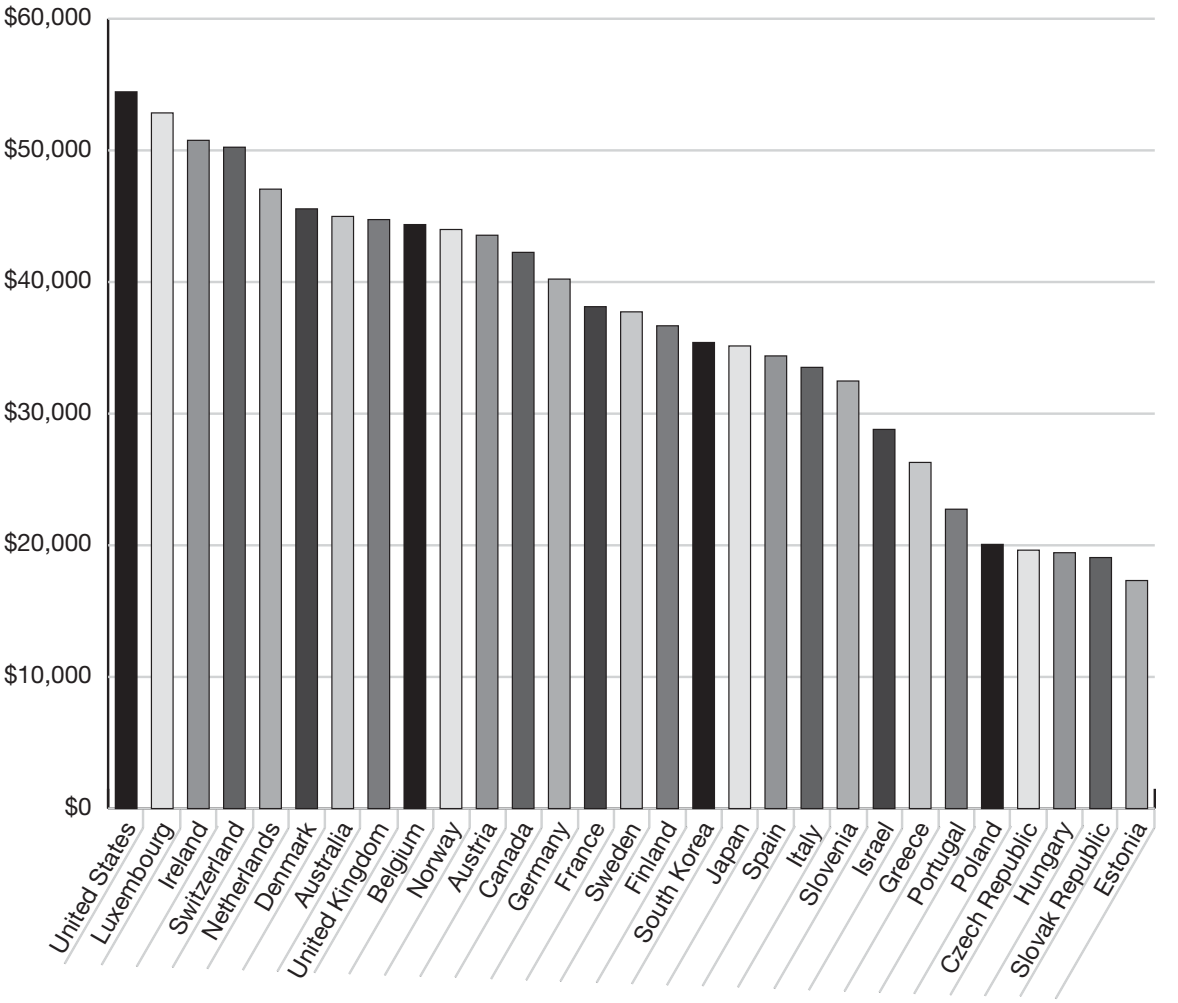
Median salary by country

Switzerland	$120,186
United States	$106,000
Japan	$101,640
Australia	$95,966
Israel	$88,309
Canada	$88,028
Netherlands	$85,307
Sweden	$79,773
Germany	$75,828
Belgium	$69,509
Chile	$69,110
United Kingdom	$66,005
Korea, South	$61,619
Finland	$60,663
Singapore	$56,452
Brazil	$51,224
France	$50,552
Italy	$48,657
Spain	$45,477
Taiwan	$40,664
Turkey	$37,309
Portugal	$36,019
Greece	$31,595
Mexico	$28,717
Czech Republic	$24,851
Malaysia	$23,785
Poland	$21,942
People's Republic of China	$15,527
Russian Federation	$15,213
Romania	$14,418
India	$12,836
Ukraine	$5,656

Table includes all countries with sample size of 30 or more.

In comparison to broader populations within surveyed countries, the optics and photonics community fares quite well. For instance, the average earnings of United States survey participants is $106,000 versus the average population at $54,540. For Poland the gap is narrower, at $21,942 in the survey versus $20,069 in the country as a whole.[4]

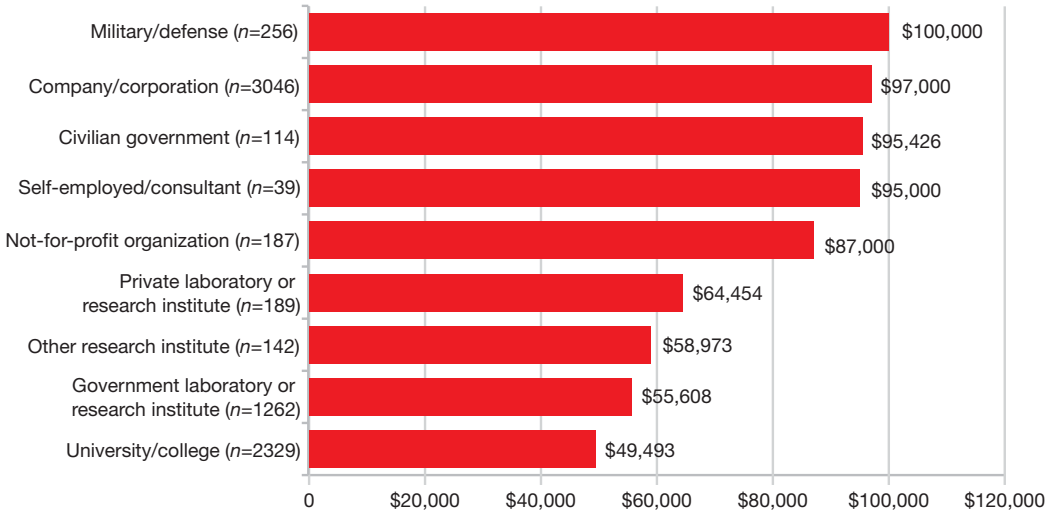
2011 Average Gross Wages by Country
(full-time year-round, from Wikipedia)[4]



Employer Type

The median salary of employees at universities is less than any other employer segment. This relationship holds across all geographic regions except for lower-income European countries, where academic employers pay 14% more than non-academic organizations.[5] In Africa and the Middle East, median wages at non-academic employers are double or more than those at universities.

Median Salary by Employer Type

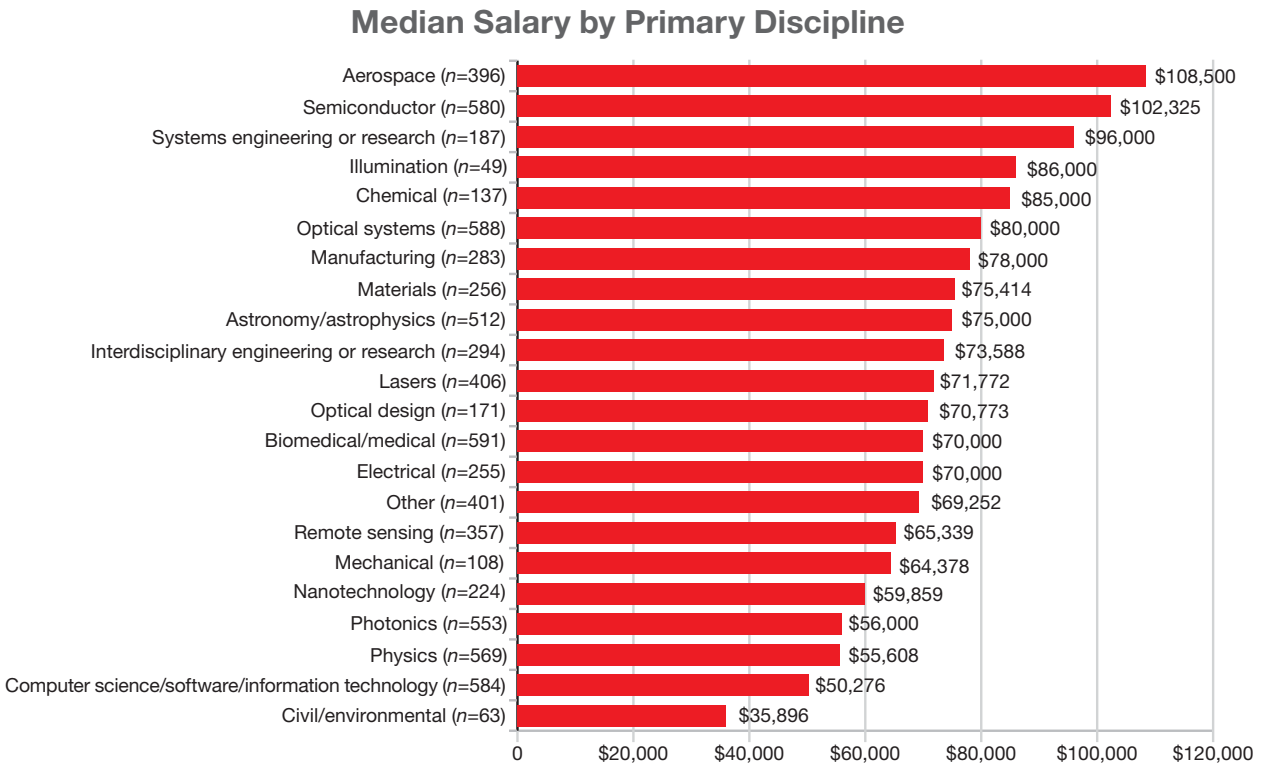


Median salary and premium by region for academic and non-academic employers

	Academic	Non-academic	Premium for Non-academic
Africa	$15,048	$48,929	225%
Middle East	$33,411	$66,657	100%
North America	$78,000	$111,667	43%
Asia, lower income	$14,296	$20,332	42%
Oceania	$87,380	$117,294	34%
Europe, higher income	$56,871	$67,219	18%
Asia, higher income	$82,582	$95,287	15%
Latin America and the Caribbean	$36,933	$38,898	5%
Europe, lower income	$20,284	$17,393	–14%

Discipline

Aerospace and semiconductor disciplines enjoy the highest median earnings, at $108,500 and $102,325, respectively. Civil/environmental, computer science, and physics fall at the opposite end of the spectrum, with median salaries ranging from $35,896 to $55,608.



The two most important factors driving salary gaps across disciplines are academic versus non-academic employment and country income level. The highest-paying disciplines are most prevalent in non-academic organizations, with the top three disciplines represented by 1046 non-academic organization respondents versus 117 working at academic institutions. Conversely, the three lowest-earning disciplines are represented by 668 respondents at academic organizations versus 548 at nonacademic employers.

Within non-academic organizations, the range of median salaries is $62,861–$111,004. For academic organizations, the range is $21,537–$75,000. The relationship between higher-pay and non-academic employment holds across all disciplines.

Country income level has a similar impact on median salaries of optics and photonics disciplines. In the lowest paid category, civil/environmental, 49% of respondents work in lower-income countries. In contrast, 89% of aerospace workers are located in higher-income countries.

Within higher-income countries, the range of median salaries across disciplines is $72,521–$115,000. Within lower-income countries, the range is $15,489–$41,945. The wage gap between higher- and lower-income countries is consistent across all disciplines.

Median salary by discipline for country income level and academic/non-academic employers

	Non-academic Employers	Academic Employers	Higher-income Countries	Lower-income Countries
Aerospace	$111,004	$66,169	$115,000	$16,708
Semiconductor	$110,000	$53,080	$113,371	$33,887
Systems engineering or research	$99,100	$51,196	$102,000	$27,357
Chemical	$103,797	$54,516	$100,000	$20,960
Illumination	$92,000	$51,955	$94,500	$30,426
Materials	$84,863	$60,000	$93,000	$18,023
Optical design	$86,819	$22,780	$92,000	$15,489
Optical systems	$88,000	$42,430	$92,000	$20,888
Lasers	$82,147	$44,039	$90,994	$17,473
Remote sensing	$78,055	$47,115	$90,994	$15,884
Electrical	$87,000	$45,682	$89,000	$23,826
Interdisciplinary engineering or research	$90,090	$50,686	$87,930	$26,554
Biomedical/medical	$90,000	$54,219	$87,025	$19,061
Mechanical	$76,000	$45,000	$85,000	$18,267
Other	$80,000	$54,838	$84,675	$18,642
Manufacturing	$80,000	$26,005	$83,000	$25,346
Computer science/software/ information technology	$79,500	$35,640	$82,147	$17,889
Astronomy/astrophysics	$74,407	$75,000	$78,793	$41,945
Nanotechnology	$72,650	$48,702	$76,000	$18,256
Civil/environmental	$64,000	$21,537	$73,458	$15,884
Photonics	$70,859	$40,664	$73,301	$19,580
Physics	$62,861	$50,552	$72,521	$15,884

Salary by Gender

Men earn 37% more than women, with respective median salaries of $76,230 and $55,608. Men also outnumber women in this survey, composing 83% of the sample. The wage gap between genders varies greatly across locations, employer types, and years of employment. The largest wage differences are associated with high-income Asian countries, employment in a company/corporation, and employment duration of 26–30 years.

Geographically, income disparities are most pronounced in Asian higher-income countries, with a gap of 79%. The Middle East falls at the opposite end of the spectrum, with men out-earning women by 7% in this small sample (Women, *n*=21).

Median salary by gender and region

	Men	Women	Premium for for Men
Asia, higher income	$95,688	$53,425	79%
Asia, lower income	$17,473	$12,707	38%
North America	$110,000	$84,000	31%
Europe, lower income	$18,957	$15,019	26%
Europe, higher income	$66,005	$53,080	24%
Oceania	$97,987	$78,810	24%
Latin America and the Caribbean	$39,257	$31,809	23%
Africa	$26,719	$23,352	14%
Middle East	$48,142	$45,000	7%

The wage gaps discussed here are consistent with findings in other surveys of workers in scientific fields, including *Nature*'s global survey of scientists.[6] *Nature* found that "Men's salaries were 18% to 40% higher than women's," depending on the country sampled.

Wage gaps between men and women also vary greatly depending on the type of employer. Women working in military/defense and civilian government earn wages that are nearly equal to men at similar employers. The bulk of survey respondents, however, work at employers where median salaries are greater for men, with a 34% gap in the company/corporation category and a 26% difference at universities/colleges. These categories are the two largest and account for 71% of respondents. The wage difference between men and women grows over time for all but the most senior employees.

Median salary by gender and employer type

	Men	Women	Premium for for Men
Private laboratory or research institute	$67,614	$47,146	43%
Company/corporation	$100,313	$75,000	34%
Other research institute	$63,190	$50,000	26%
University/college	$50,552	$40,000	26%
Government laboratory or research institute	$56,871	$46,129	23%
Not-for-profit organization	$88,233	$75,000	18%
Military/defense	$100,400	$96,750	4%
Civilian government	$95,426	$96,405	–1%

Categories with sample sizes below 10 have been omitted.

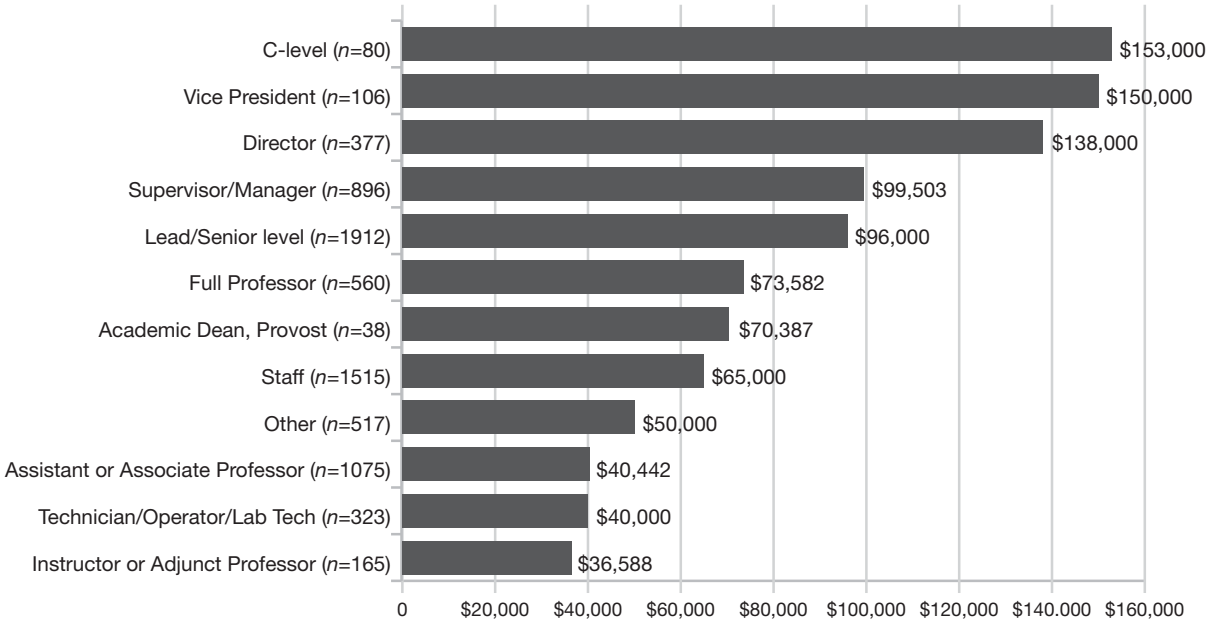
Median salary by gender and years employed

Total years professionally employed	Men	Women	Premium for for Men
Less than 5 years	$46,000	$40,860	13%
5–10 years	$56,871	$48,952	16%
11–15 years	$80,884	$63,525	27%
16–20 years	$97,000	$67,488	44%
21–25 years	$107,000	$73,209	46%
26–30 years	$120,000	$63,576	89%
More than 30 years	$115,000	$79,600	44%

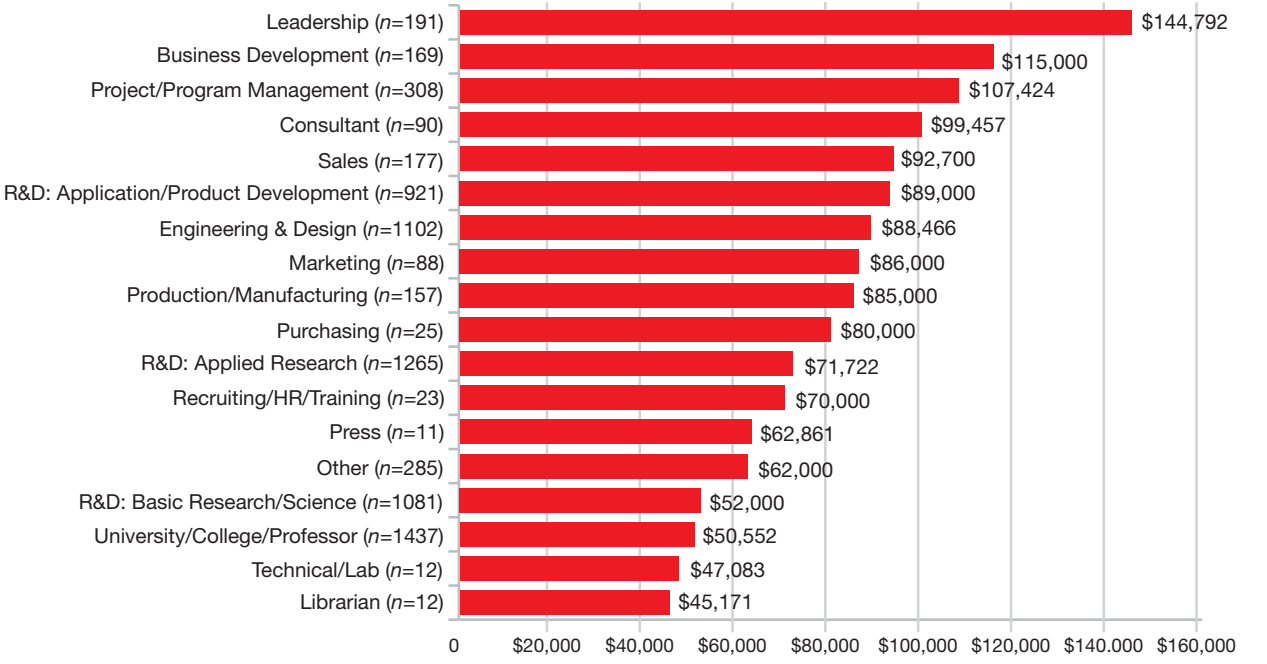
Other Factors

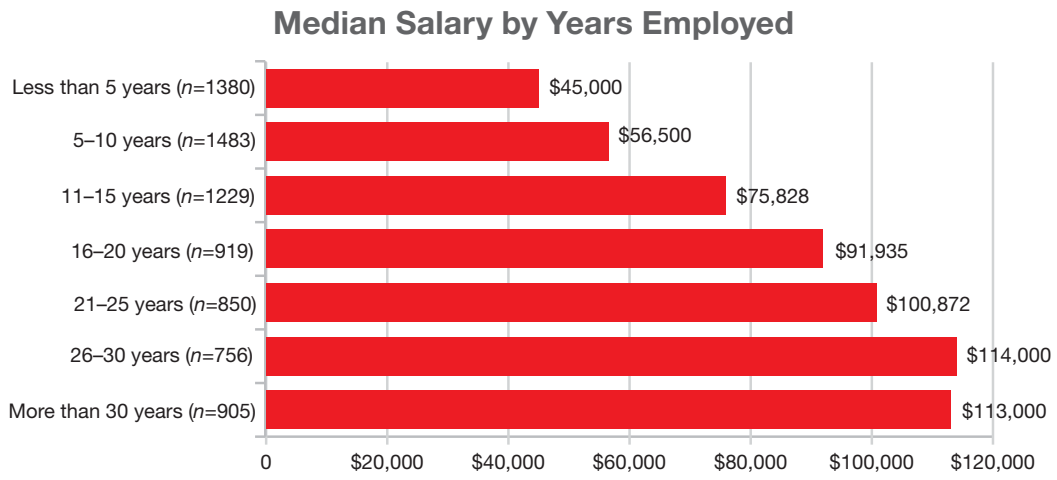
Other factors that influence salary include job level, job role, years employed, and size of organization. Unsurprisingly, top organizational leaders enjoy the highest salaries, while technicians and librarians anchor the bottom of the range. Seniority also tracks well with salary levels, although the relationship between organization size and income is uneven.

Median Salary by Job Title

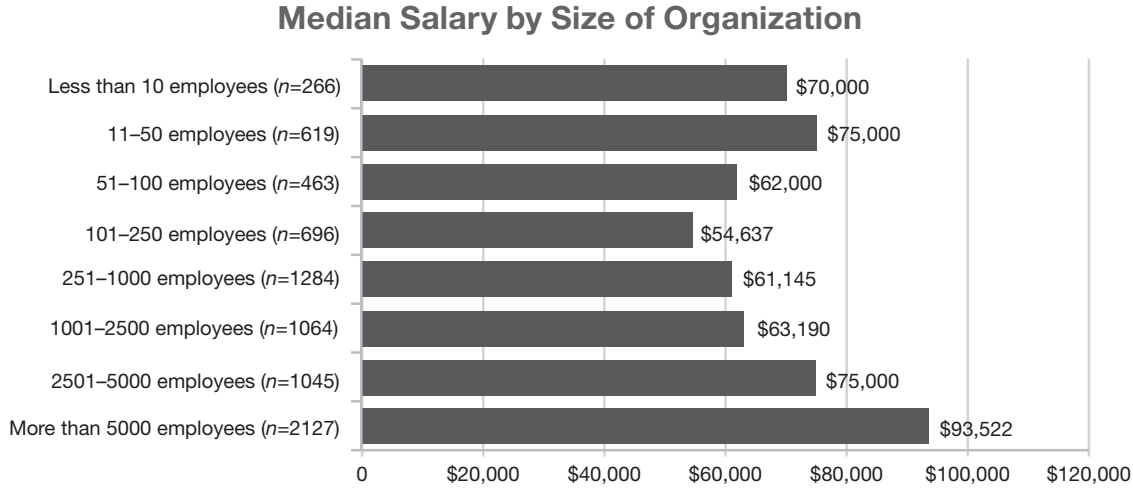


Median Salary by Job Role





Median salaries are highest at the largest organizations, those with more than 5,000 employees, followed by the smallest organizations, those with less than 10 employees. Unsurprisingly, these categories of employers are highly concentrated in higher-income countries.

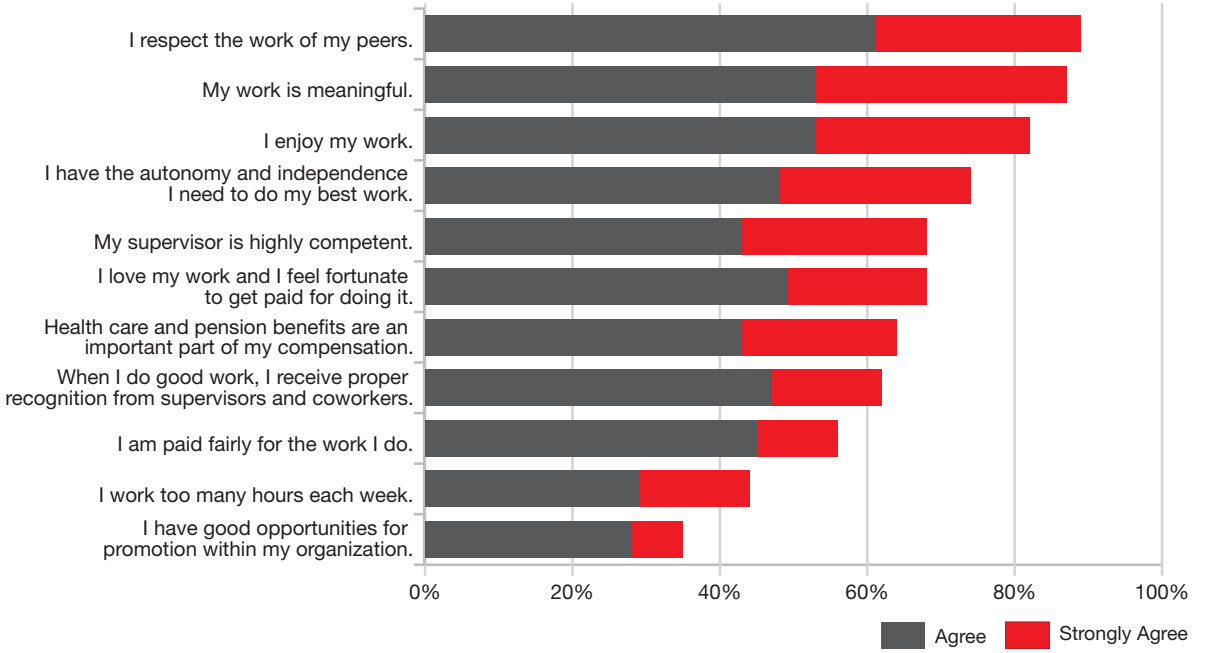


Job Satisfaction

A significant majority of the optics and photonics community is highly satisfied with core aspects of its working life. 82% say they enjoy their work, 87% find their work meaningful, and 89% respect the work of their peers. Majorities are also satisfied with their pay, their supervisors, and the positive recognition they receive, with 67% agreeing with the statement "I love my work and I feel fortunate to get paid for doing it."

Almost half of respondents (44%) consider themselves overworked. Men and women show similar levels of satisfaction across all questions, including fairness of pay, despite the 37% gap in salary noted earlier.

The single clearly negative finding in the survey relates to opportunity for advancement, with only 35% agreeing that there are "good opportunities for promotion" within their organizations. This finding is unsurprising in light of current economic conditions.

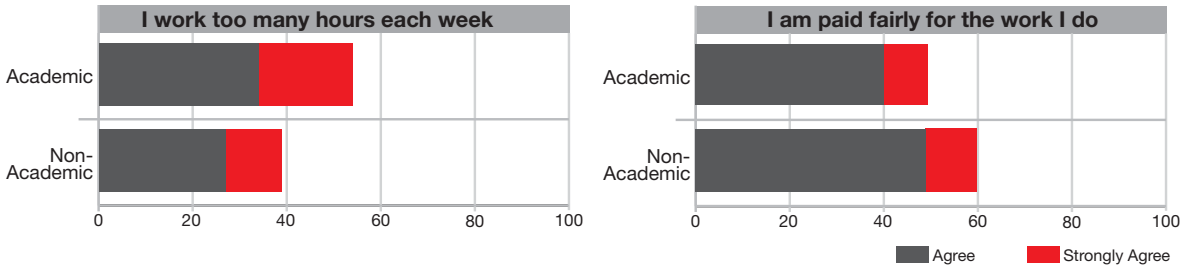


Perception of Fair Pay by Median Salary

"I am paid fairly for the work I do"		% of respondents	Median Salary
	Strongly agree	11%	$100,000
	Agree	45%	$86,434
	Neither agree nor disagree	19%	$65,000
	Disagree	19%	$53,663
	Strongly disagree	5%	$37,595

Satisfaction with pay correlates highly with rising median incomes—respondents most satisfied with their pay earn $100,000 while those least satisfied earn $37,595. Non-academic respondents are happier with their workload and pay in comparison to their academic colleagues.

Workload and Pay for Academic and Non-Academic Organizations



Though generally consistent, several satisfaction measures vary by region. Only 26% of higher-income Europeans are optimistic about opportunities for promotion, in contrast to their North American (36%) and higher-income Asian peers (40%). North Americans place a higher premium on health care and pension benefits, no doubt driven by the United States' employer-based insurance system. African respondents feel that they lack autonomy and independence relative to their counterparts elsewhere.

Job Satisfaction by Region

	Africa	Asia higher income	Asia lower income	Europe higher income	Europe lower income	Latin America and the Caribbean	Middle East	North America	Oceania
I respect the work of my peers.	91%	79%	84%	90%	83%	91%	86%	91%	88%
My work is meaningful.	79%	86%	85%	86%	84%	88%	87%	88%	83%
I enjoy my work.	82%	74%	73%	85%	88%	89%	86%	83%	87%
I have the autonomy and independence I need to do my best work.	55%	65%	67%	75%	73%	76%	70%	78%	83%
I love my work and I feel fortunate to get paid for doing it.	70%	71%	64%	67%	72%	76%	74%	67%	72%
My supervisor is highly competent.	54%	61%	59%	65%	64%	68%	63%	75%	67%
When I do good work, I receive proper recognition from supervisors and coworkers.	50%	60%	65%	59%	56%	53%	61%	66%	65%
Health care and pension benefits are an important part of my compensation.	52%	67%	64%	47%	31%	54%	63%	79%	39%
I am paid fairly for the work I do.	52%	54%	48%	50%	38%	54%	54%	66%	66%
I work too many hours each week.	63%	49%	55%	46%	48%	49%	53%	38%	39%
I have good opportunities for promotion within my organization.	54%	40%	46%	26%	36%	38%	45%	36%	32%

Values reflect sums of those agreeing or strongly agreeing with each statement.

Methodology and Footnotes

In April and May of 2012, SPIE sent email survey invitations to its global customer database. Surveys were completed online using Vovici's enterprise survey tool. Results were filtered to yield 7,565 valid responses. Response was voluntary and open. An iPad raffle and early access to this report were offered as incentives to encourage participation. Any response lacking salary data was removed, as were duplicates and responses from students, the part-time employed, and unemployed. Microsoft Excel and SPSS were utilized to create summary statistics and related disaggregations.

Notes:

1. U.S. dollars are used throughout. Local currencies were converted using May 2012 market exchange rates. Salary figures include total yearly compensation, both base pay and bonuses.

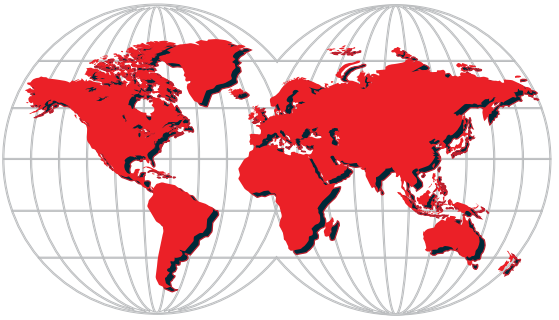
2. United States (3161), People's Republic of China (530), Germany (449), Italy (296), United Kingdom (286), France (223), Japan (211), Spain (194), Canada (184), India (176), Russian Federation (147), Netherlands (120), Taiwan (112), South Korea (101), Australia (84), Israel (75), Belgium (71), Brazil (70), Switzerland (66), Mexico (61), Sweden (57), Singapore (54), Poland (53), Romania (45), Chile (43), Portugal (39), Czech Republic, Finland (38), Turkey (36), Malaysia (35), Greece, Ukraine (30), Austria (27), Denmark (26), Ireland (22), Egypt (21), Pakistan, South Africa (20), Bulgaria, Norway (19), Armenia (18), Colombia (16), Argentina, Hungary, Iran (15), Saudi Arabia (13), Algeria, Lithuania, Slovenia (11), Estonia (10), Latvia, Thailand (9), Belarus, New Zealand (8), Croatia, Slovakia (7), Morocco, Serbia, Vietnam (5), Georgia, Indonesia, Iraq, Nigeria, Peru (4), Ecuador, Ethiopia, Jordan, Kuwait, Lebanon, Uzbekistan, Venezuela (3), Cyprus, Iceland, Libya, Liechtenstein, Oman, Tunisia, United Arab Emirates (2), Azerbaijan, Bangladesh, Bosnia, Cameroon, Cape Verde, Central African Republic, Ghana, Kazakhstan, Kenya, Kyrgyzstan, Malta, Moldova, Monaco, Mozambique, Nepal, Palestine State, Philippines, Qatar, Syria, Tanzania, Uganda, Uruguay, Zimbabwe (1).

3. The higher-earning regions, North America and Oceania, are composed of countries with similarly high per capita gross national income (GNI) levels. Europe and Asia are composed of a much broader mix of income levels. For example, the survey sample for Asia includes Pakistan, People's Republic of China, and Japan, with per capita GNIs of $1050, $4270, and $41,850, respectively. Similarly, Europe includes Ukraine, Poland, and Denmark, at $3000, $12,440, and $59,400. Subcategories were created by using the per capita GNI of New Zealand as the lower boundary of the higher-income subcategory, at $28,770. New Zealand has the lowest per capita GNI in the North America and Oceania groups. This $28,770 per capita GNI threshold is used throughout this report when referring to "higher-income" and "lower-income" countries. For information on per capita GNI, see http://data.worldbank.org/about/country-classifications/world-bank-atlas-method

4. Averages are displayed since median wage data is unavailable for most countries. Data are average annual wages per full-time and full-year equivalent employee in the total economy, 2011 USD PPP, from http://stats.oecd.org. Retrieved 30 July 2012.

5. The category "non-academic employers" is composed of company/corporation, military/defense, not-for-profit organization, private laboratory or research institute, self-employed/consultant, government lab or research institute, and civilian government. "Academic employers" is composed of university/college and other research institute.

6. Gene Russo, "For Love and Money," *Nature*, June 2010, pp. 1104-1107.



SPIE Connecting minds. Advancing light.

Statement of Purpose

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

About the Society

SPIE, the international society for optics and photonics, was founded in 1955 to advance light-based technologies.

Serving more than 225,600 constituents from approximately 150 countries, the Society advances emerging technologies through interdisciplinary information exchange, continuing education, publications, patent precedent, and career and professional growth.

SPIE annually organizes and sponsors approximately 25 major technical forums, exhibitions, and education programs in North America, Europe, Asia, and the South Pacific.

In 2011, the Society provided more than $2.7 million in support of scholarships, grants, and other education programs around the world.

SPIE publishes the SPIE Digital Library, containing more than 375,000 research papers from the Proceedings of SPIE and the Society's 9 scholarly journals with around 18,000 new papers added each year, and more than 165 eBooks from the SPIE Press catalog. The SPIE Press publishes print monographs, tutorial texts, Field Guides, and reference books. SPIE also publishes a wide variety of open access content.

Membership includes Fellows and Senior Member programs. The Society has named more than 900 SPIE members as Fellows since 1955, and implemented its Senior Member program in 2008.

The SPIE awards program serves to recognize outstanding contributions from individuals throughout the scientific community regardless of membership status.

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