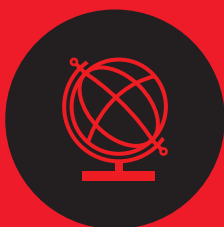


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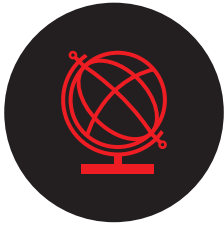
THE INTERNATIONAL SOCIETY
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2014 OPTICS & PHOTONICS GLOBAL SALARY REPORT.

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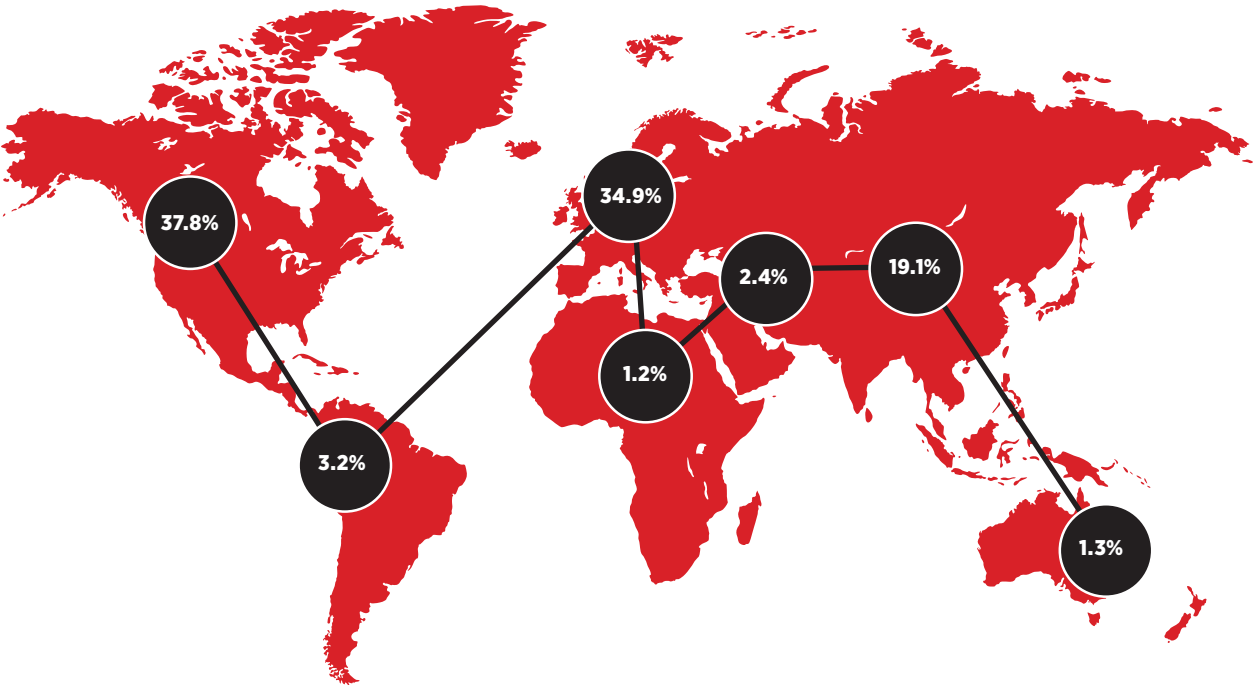
THE 2014 OPTICS & PHOTONICS GLOBAL SALARY REPORT IS SPONSORED BY SPIE CAREER CENTER

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Key Findings

- The median salary for survey respondents is \$73,000.¹ Salaries are widely distributed around this midpoint, with differences primarily driven by country income level and employer type.
- The highest-paid discipline is aerospace, with a median income of \$116,269.
- For-profit respondents see product innovation as a key element of career success, versus academic and government respondents who place high value on scientific discovery.
- Survey respondents are highly satisfied with their jobs overall: 85% enjoy their work, while 88% respect the work of their peers.
- 40% of workers in higher-income Asian countries work 50 or more hours per week. 21% of Romanian workers report working 55 or more hours per week, the largest percentage of any country. Japan follows closely, with 20% working 55 hours or more per week.
- 91% of workers in lower-income Asian countries expect a raise in 2014 versus 58% of lower-income Europeans.
- Median salaries are 40% higher overall for men than for women, with the largest gap occurring late-career.

SURVEY RESPONSES BY REGION



**NORTH
AMERICA**
37.8%

**LATIN AMERICA
AND THE
CARIBBEAN**
3.2%

EUROPE
34.9%

AFRICA
1.2%

**MIDDLE
EAST**
2.4%

ASIA
19.1%

OCEANIA
1.3%

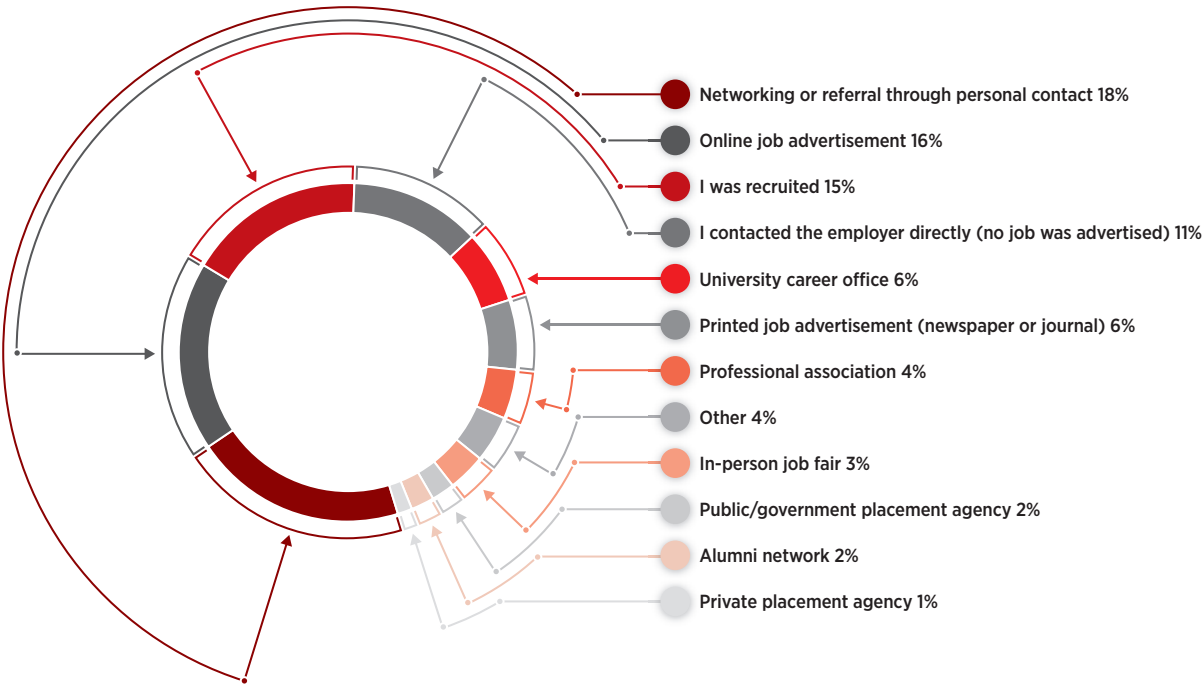
Background

SPIE conducted the fourth annual Optics and Photonics Global Salary Survey in February 2014. 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 6,000 valid responses were gathered from 103 countries.² 92% of participants are located in North America, Europe, and Asia. Respondents from Latin America/Caribbean, the Middle East, Oceania,³ and Africa account for the balance of data.

For this year’s report, questions about career success and mobility were added to the existing categories of geographic region, professional focus, gender, and employer type. Results for 2014 are broadly consistent with previous years. For complete survey methodology, please see page 19.

HOW DID YOU FIND YOUR CURRENT POSITION?



Country Overview

The countries covered in the survey represent a broad range of incomes, work habits, and levels of job satisfaction. Workers in Switzerland, the United States, and Israel enjoy the highest median salaries.

MEDIAN SALARY, HIGH WORKLOAD, AND JOB SATISFACTION BY COUNTRY

	Median Salary	Work 55 or more hours per week	"I enjoy my work"
Switzerland (n=78)	\$124,599	10%	88%
United States (n=2121)	\$110,000	12%	84%
Israel (n=61)	\$100,497	13%	87%
Netherlands (n=103)	\$96,546	8%	88%
Germany (n=388)	\$93,443	10%	86%
Australia (n=76)	\$92,771	5%	86%
Canada (n=154)	\$80,207	10%	87%
Sweden (n=38)	\$79,825	0%	86%
Japan (n=251)	\$78,233	20%	74%
Belgium (n=58)	\$71,444	7%	85%
United Kingdom (n=256)	\$70,489	7%	85%
South Korea (n=132)	\$65,695	13%	73%
Chile (n=32)	\$64,531	9%	83%
Singapore (n=41)	\$62,780	17%	77%
France (n=218)	\$58,617	8%	88%
South Africa (n=26)	\$48,636	15%	88%
Italy (n=254)	\$48,581	9%	91%
Spain (n=176)	\$48,273	3%	90%
Brazil (n=57)	\$47,332	5%	94%
Taiwan (n=99)	\$45,712	18%	73%
Mexico (n=59)	\$30,234	15%	98%
Colombia (n=25)	\$28,071	4%	92%
Turkey (n=38)	\$26,865	5%	95%
Czech Republic (n=26)	\$26,398	0%	88%
Malaysia (n=25)	\$24,182	12%	96%
Poland (n=57)	\$21,360	12%	81%
Russia (n=149)	\$16,549	11%	82%
Peoples Republic of China (n=392)	\$16,064	14%	76%
Romania (n=28)	\$15,989	21%	92%
India (n=124)	\$13,945	14%	92%
Ukraine (n=28)	\$5,701	14%	88%
Table includes all countries with a sample size of 25 or more.			

Mexico, Malaysia, and Turkey are at the top of the job satisfaction scale, with 95% or more of their respondents saying that they enjoy their work. The nine highest countries on this scale have salaries below the median for the overall sample, suggesting that high absolute pay does not predict job satisfaction.

Romania tops the list for heavy workload, with 21% of respondents reporting they work 55 hours or more per week. In the highest-paid countries, those in Japan report working the most hours while people in Australia and Sweden work the fewest.

In comparison to broader populations within surveyed countries, the optics and photonics community fares quite well. For example, the median earnings of Dutch survey participants is \$96,546 versus the average for the general population at \$52,309. In the Czech Republic, survey participants earn \$26,398 versus \$15,947 for the country.⁴

Job Satisfaction

A significant majority of the optics and photonics community is highly satisfied with core aspects of its working life. 85% say they enjoy their work and find it meaningful, while 88% respect the work of their peers. Majorities are also satisfied with their pay, their supervisors, and the positive recognition they receive, with 78% agreeing with the statement “I love my work and I feel fortunate to get paid for doing it.”

Just over a third of respondents (35%) consider themselves overworked. Men and women show similar levels of satisfaction across all questions, including fairness of pay, despite a 40% gap in salary.

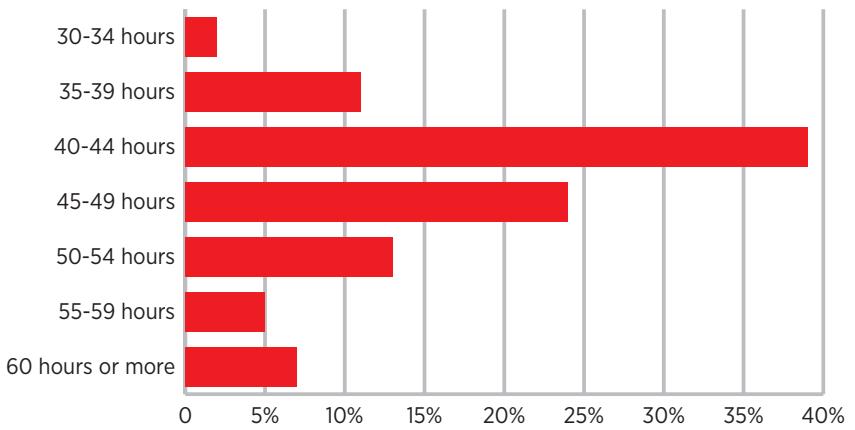
The single clearly negative finding in the survey relates to opportunity for advancement, with only 35% agreeing that there are “good opportunities for promotion” within their organizations.



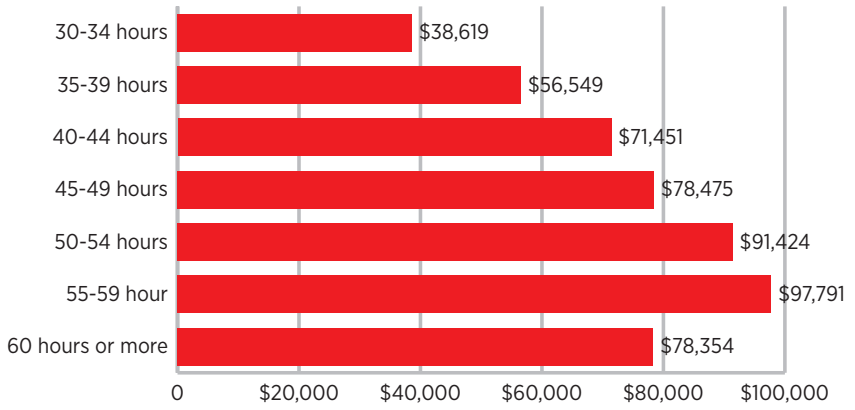
Workload

Most survey respondents work between 40 and 50 hours per week (63%), while just under a quarter report that they work 50 hours or more (24%). Higher workloads align with higher salaries except for those working 60 hours or more per week. Higher workloads also correlate roughly with higher job satisfaction.

PERCENTAGE OF RESPONDENTS BY HOURS WORKED PER WEEK

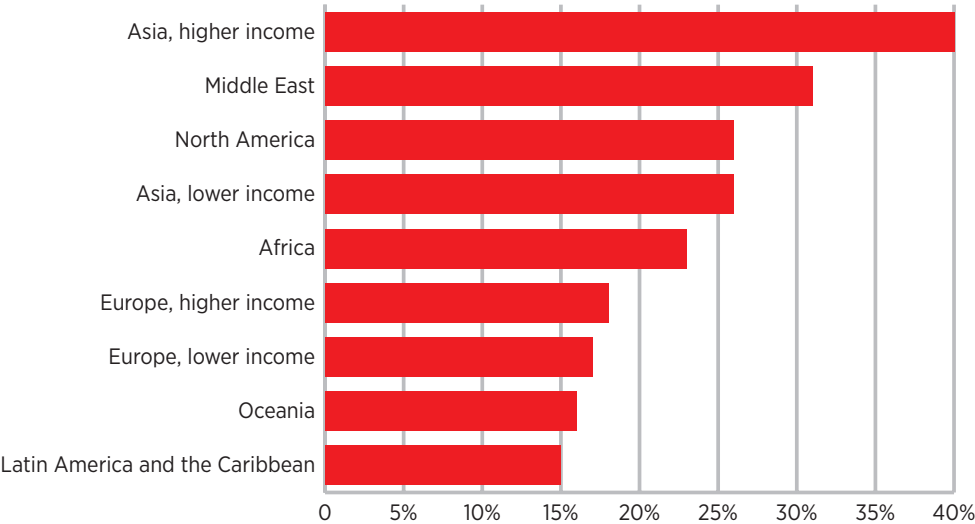


MEDIAN SALARY BY HOURS WORKED PER WEEK



Respondents from higher-income Asian⁵ countries spend the most time in their offices and labs, with 40% working 50 hours or more per week and only 6% working less than 40 hours per week. Middle Easterners are next, with 31% working 50 or more hours, though 17% work less than 40 hours.

PERCENTAGE OF RESPONDENTS WORKING 50 HOURS OR MORE PER WEEK



Median salary is highest for respondents working 55–59 hours per week.

Mobility

North Americans change employers more frequently than their colleagues in other regions. Among those who have been working for thirty or more years, only 10% of North Americans remain at their original employer. In contrast, 50% of respondents in lower-income Asian countries and 38% in higher-income European countries are lifelong employees at a single organization.

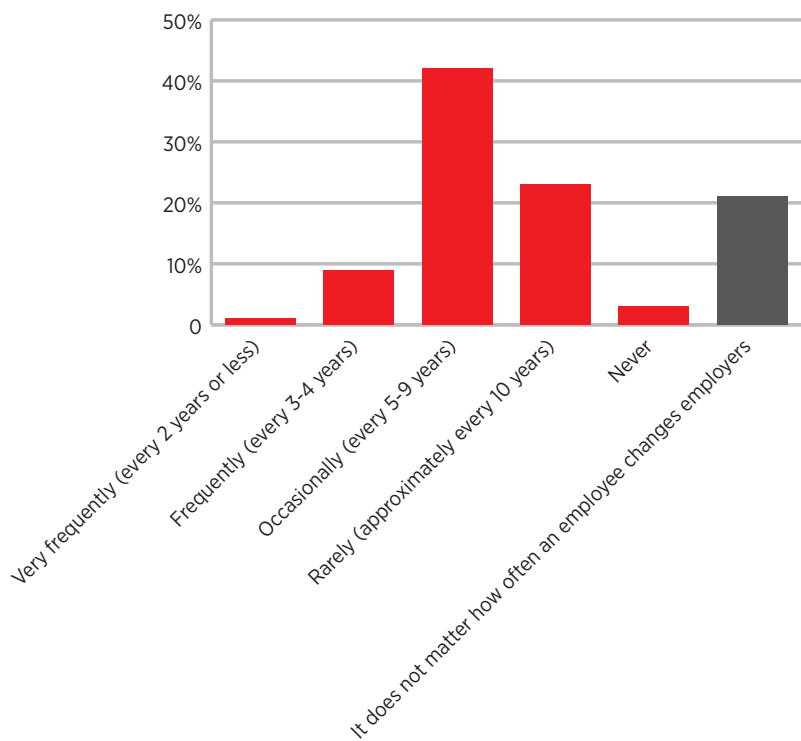
When asked about how often an employee should change careers, only 3% of respondents suggest remaining at the same employer for an entire career, though almost a quarter recommend moving only once every decade. One in five respondents say that the frequency of employment changes does not affect career success.

OVER YOUR CAREER, ON AVERAGE HOW OFTEN HAVE YOU CHANGED EMPLOYERS?

	Asia, lower income (n=24)	Europe, higher income (n=238)	Asia, higher income (n=37)	North America (n=433)
Every two years or less	0%	0%	0%	1%
Every three to four years	0%	0%	0%	7%
Every five to nine years	8%	18%	16%	33%
Every ten to twenty years	29%	21%	19%	29%
Every twenty or more years	13%	23%	38%	21%
I have been at the same organization for my entire career	50%	38%	27%	10%

For people employed 30 or more years in regions yielding 20 or more respondents.

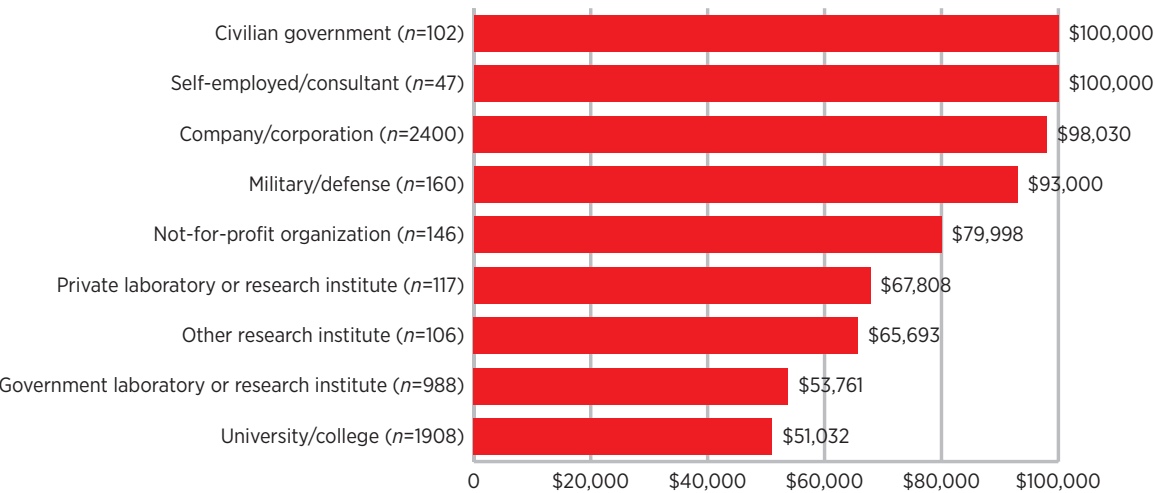
IDEALLY, HOW OFTEN SHOULD AN EMPLOYEE CHANGE EMPLOYERS IN A SUCCESSFUL CAREER?



Employer Type

Median salaries at for-profit companies are well above those in government/military and academic sectors, though some subcategories defy the general pattern.⁷ The relationship holds across all geographic regions, with the largest gap in the lower-income European countries, where for-profit salaries are 270% above those at academic organizations. Differences are smallest in higher-income Asian countries and Oceania.

MEDIAN SALARY BY EMPLOYER TYPE

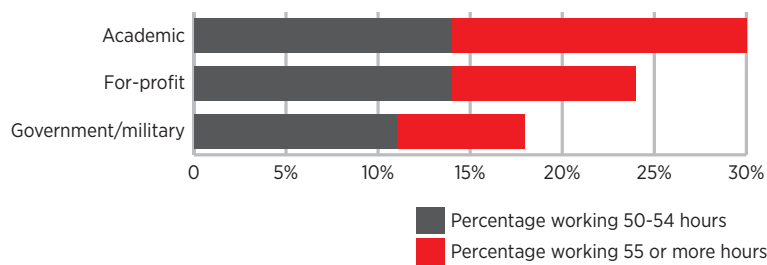


MEDIAN SALARY AND PREMIUM BY REGION:
FOR-PROFIT, ACADEMIC, AND GOVERNMENT/MILITARY EMPLOYERS

	For-profit	Government/Military	Academic	For-profit vs. Academic
Europe, lower income	\$21,095	\$8,277	\$5,701	270%
Africa	\$47,719	\$18,239	\$15,200	214%
Middle East	\$90,660	\$49,000	\$32,007	183%
Europe, higher income	\$82,963	\$55,169	\$55,169	50%
Asia, lower income	\$21,327	\$16,405	\$14,458	48%
North America	\$115,000	\$109,250	\$82,000	40%
Latin America and the Caribbean	\$46,546	\$49,483	\$33,795	38%
Asia, higher income	\$69,698	\$50,445	\$58,773	19%
Oceania	\$102,190	\$98,735	\$86,294	18%

Academics work the most hours, with 30% working fifty or more hours per week. Government/military workers spend the least time on the job, with 18% working fifty or more hours per week.

**HEAVY WORKLOADS AT FOR-PROFIT, ACADEMIC,
AND GOVERNMENT/MILITARY ORGANIZATIONS**



For-profit employees
earn more and work
fewer hours than their
academic colleagues.



DEFINING SUCCESS IN OPTICS AND PHOTONICS.

Respondents were asked the question “How do you define success in your career?” then asked to rank their choices.

Career success is tied to team success for optics and photonics workers, with respondents in all categories placing “the success of my team or work group”⁶ at or near the top of their rankings. There are, however, some clear differences in priorities across workplace types and regions.

Product innovation ranks much higher at for-profit companies, whereas advancing scientific discovery is paramount for academics and government/military workers. Regionally, professional recognition is much more important in Asia and Europe than North America. North Americans place a higher value on leading their organizations to success versus the other regions. Pay and job promotion fail to make the top three in any category.



How do you define success in your career?

TOP 10 BY ORGANIZATION TYPE

ACADEMIC

- 1 Scientific Discovery
- 2 Team Success
- 3 Recognition
- 4 Mentoring Success
- 5 Publishing
- 6 Contracts/Grants
- 7 Better World
- 8 Organization's Success
- 9 Pay
- 10 Product Innovation

FOR-PROFIT

- 1 Team Success
- 2 Organization's Success
- 3 Product Innovation
- 4 Pay
- 5 Recognition
- 6 Job Promotion
- 7 Scientific Discovery
- 8 Better World
- 9 Mentoring Success
- 10 Employee Wellbeing

GOVERNMENT/ MILITARY

- 1 Scientific Discovery
- 2 Team Success
- 3 Recognition
- 4 Organization's Success
- 5 Pay
- 6 Product Innovation
- 7 Mentoring Success
- 8 Publishing
- 9 Contracts/Grants
- 10 Better World

TOP 10 BY REGION

NORTH AMERICA

- 1 Team success
- 2 Organization's Success
- 3 Scientific Discovery
- 4 Pay
- 5 Product Innovation
- 6 Mentoring Success
- 7 Better World
- 8 Recognition
- 9 Job Promotion
- 10 Employee Wellbeing

EUROPE, HIGHER INCOME

- 1 Team Success
- 2 Scientific Discovery
- 3 Recognition
- 4 Product Innovation
- 5 Organization's Success
- 6 Pay
- 7 Mentoring Success
- 8 Contracts/Grants
- 9 Better World
- 10 Job Promotion

ASIA, LOWER INCOME

- 1 Scientific Discovery
- 2 Recognition
- 3 Team Success
- 4 Organization's Success
- 5 Mentoring Success
- 6 Pay
- 7 Product Innovation
- 8 Contracts/Grants
- 9 Job Promotion
- 10 Publishing

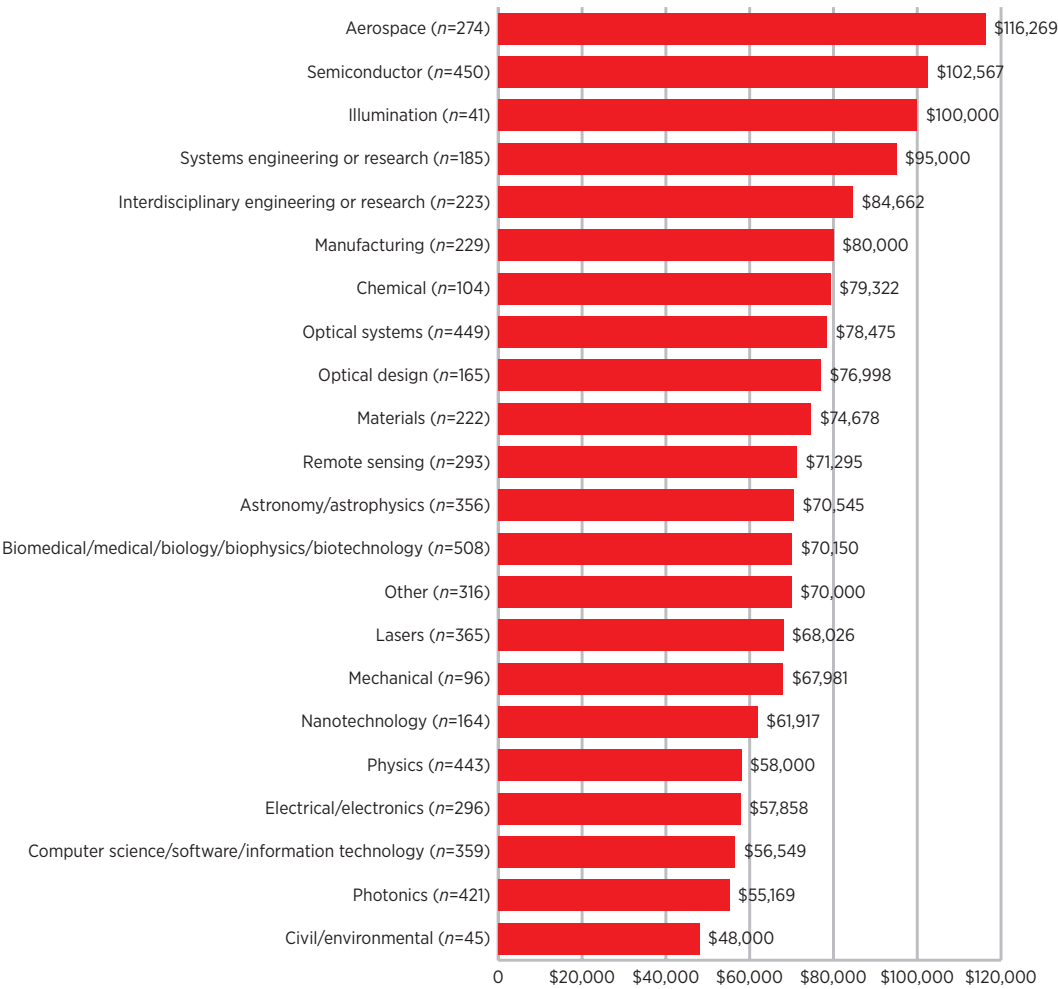
ASIA, HIGHER INCOME

- 1 Recognition
- 2 Team Success
- 3 Scientific Discovery
- 4 Pay
- 5 Product Innovation
- 6 Organization's Success
- 7 Job Promotion
- 8 Mentoring Success
- 9 Publishing
- 10 Employee Wellbeing

Discipline

Aerospace and semiconductor disciplines enjoy the highest median earnings, at \$116,269 and \$102,567, respectively. Civil/environmental falls at the opposite end of the spectrum, with a median salary of \$48,000.

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: The top three disciplines by pay (aerospace, semiconductor, and illumination) have 538 people at for-profits versus 138 in government/military and 69 in academia.

Within for-profit organizations, the range of median salaries is \$56,893–\$124,599. For government/military organizations, the range is \$41,377–\$104,000. At academic organizations, the range is \$23,447–82,754. For-profit pay is highest in every discipline with the exception of manufacturing, where the relatively small sample of government/military respondents (10) receive higher pay.

Country income level has a similar impact on median salaries of optics and photonics disciplines. In the highest paid category, aerospace, 258 out of 274 workers are located in higher-income countries. Within higher-income countries, the range of median salaries across disciplines is \$57,585–\$120,000. Within lower-income countries, the range is \$8,878–\$24,096. The wage gap between higher- and lower-income countries is consistent across all disciplines.

**MEDIAN SALARY BY DISCIPLINE FOR ACADEMIC/
NON-ACADEMIC EMPLOYERS AND COUNTRY INCOME LEVEL**

	For-profit Employers	Government/ Military Employers	Academic Employers	Higher- income Countries	Lower-income Countries
Aerospace	\$124,599	\$104,000	\$82,754	\$120,000	\$21,464
Semiconductor	\$110,339	\$56,000	\$68,962	\$106,224	\$21,615
Remote sensing	\$109,500	\$69,512	\$41,377	\$86,217	\$16,064
Illumination	\$109,000	\$46,264	\$72,410	\$101,000	\$11,627
Chemical	\$106,201	\$48,273	\$57,227	\$81,561	\$8,878
Systems engineering or research	\$104,132	\$75,927	\$57,585	\$100,497	\$22,490
Materials	\$101,000	\$57,771	\$55,169	\$80,103	\$24,096
Optical systems	\$100,000	\$62,329	\$34,481	\$90,309	\$16,064
Biomedical/medical/ biology/biophysics/ biotechnology	\$99,305	\$50,891	\$51,032	\$79,146	\$15,958
Interdisciplinary engineering or research	\$97,791	\$92,451	\$51,032	\$90,000	\$16,235
Physics	\$92,175	\$52,411	\$57,928	\$66,919	\$12,851
Nanotechnology	\$91,000	\$51,032	\$52,837	\$68,029	\$20,274
Photonics	\$89,650	\$41,377	\$49,212	\$66,203	\$17,670
Electrical/electronics	\$89,500	\$44,136	\$36,092	\$74,000	\$17,212
Optical design	\$89,325	\$44,597	\$58,962	\$85,000	\$23,122
Lasers	\$85,871	\$53,289	\$35,197	\$82,754	\$16,064
Other	\$85,039	\$70,481	\$50,000	\$78,616	\$19,277
Mechanical	\$81,617	\$63,112	\$40,000	\$84,552	\$21,232
Manufacturing	\$80,320	\$85,000	\$55,700	\$84,662	\$18,474
Astronomy/astrophysics	\$75,848	\$60,686	\$74,172	\$75,848	\$24,096
Computer science/ software/information technology	\$68,962	\$51,032	\$47,768	\$68,962	\$16,405
Civil/environmental	\$56,893	\$44,006	\$23,447	\$57,585	\$14,328

Gender

Men earn 40% more than women, with respective median salaries of \$77,000 and \$55,169. Men also outnumber women in this survey, composing 84% of the sample. The largest wage differences are associated with African and higher-income Asian countries, employment at “other research institute,” and employment duration of thirty or more years. The wage gaps outlined here are consistent with *Nature’s* finding that “Large salary disparities persist between male and female researchers.”⁸

MEDIAN SALARY BY GENDER AND REGION

	Men	Women	Premium for Men
Asia, higher income	\$65,037	\$38,893	67%
Africa	\$27,530	\$16,518	67%
Europe, lower income	\$9,501	\$6,061	57%
Europe, higher income	\$68,962	\$49,652	39%
North America	\$111,000	\$82,000	35%
Asia, lower income	\$16,064	\$13,124	22%
Oceania	\$95,378	\$86,294	11%
Latin America and the Caribbean	\$37,297	\$41,572	-10%
Categories with sample sizes below 10 have been omitted.			

MEDIAN SALARY BY GENDER AND EMPLOYER TYPE

	Men	Women	Premium for Men
Other research institute	\$71,931	\$45,515	58%
Not-for-profit organization	\$87,720	\$58,275	51%
Military/defense	\$95,000	\$64,165	48%
Company/corporation	\$100,000	\$74,000	35%
University/college	\$52,411	\$44,520	18%
Government laboratory or research institute	\$55,343	\$48,273	15%
Private laboratory or research institute	\$68,962	\$64,222	7%
Civilian government	\$100,000	\$96,546	4%
Categories with sample sizes below 10 have been omitted.			

MEDIAN SALARY BY GENDER AND YEARS EMPLOYED

	Men	Women	Premium for Men
Less than 5 years	\$46,168	\$45,000	3%
5-10 years	\$57,927	\$45,253	28%
11-15 years	\$74,199	\$62,066	20%
16-20 years	\$91,515	\$81,000	13%
21-25 years	\$97,396	\$81,377	20%
26-30 years	\$110,000	\$87,000	26%
More than 30 years	\$113,800	\$78,616	45%

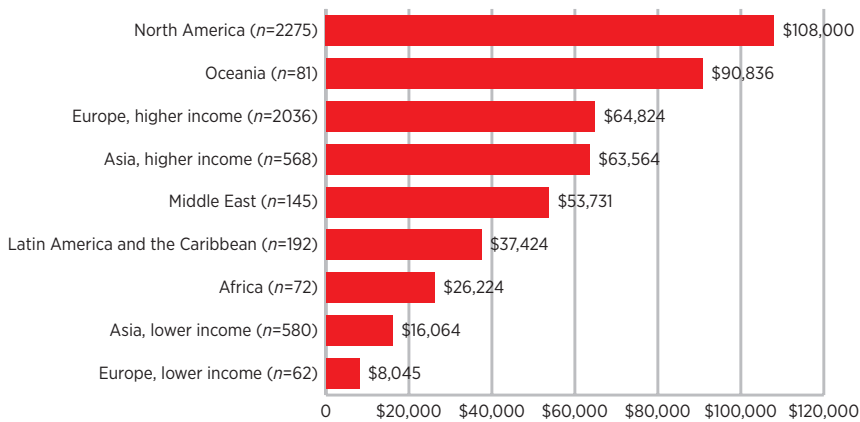
The gender wage gap is 18% at universities/colleges versus 35% at companies/corporations.



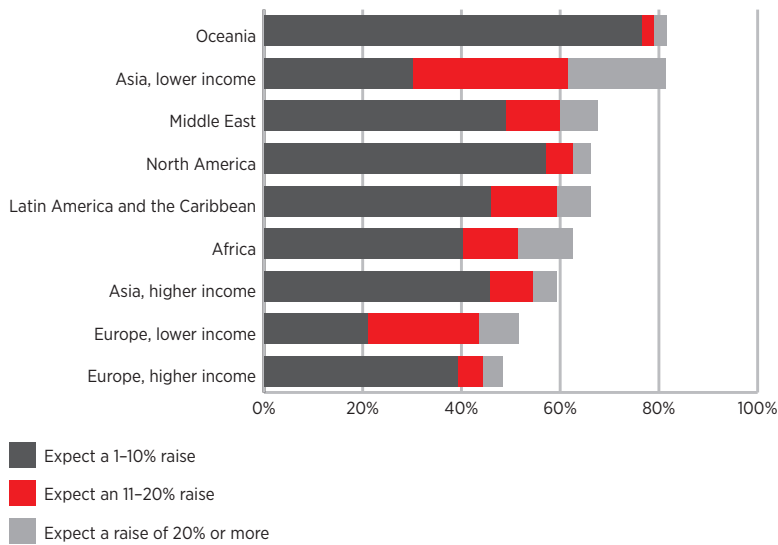
Region

North America and Oceania stand out as the regions with the highest salaries, with median earnings well above other areas. North American median incomes are 70% greater than higher-income Asian countries and 67% greater than higher-income European countries. A large portion of regional income gaps is explained by the level of economic development of countries within each area. Workers in lower-income Asian countries and Oceania are most optimistic about future increases in pay, with 81% expecting raises in 2014.

MEDIAN SALARY BY REGION



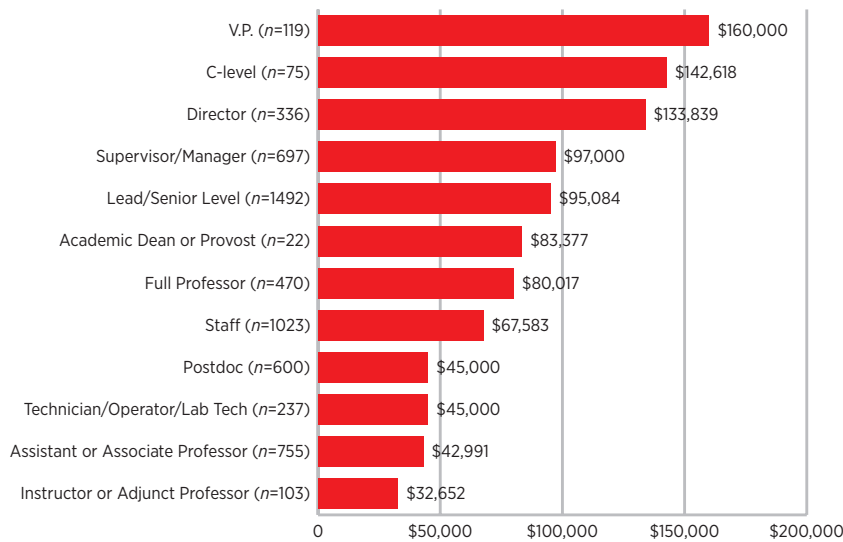
PERCENTAGE OF RESPONDENTS EXPECTING A RAISE IN 2014



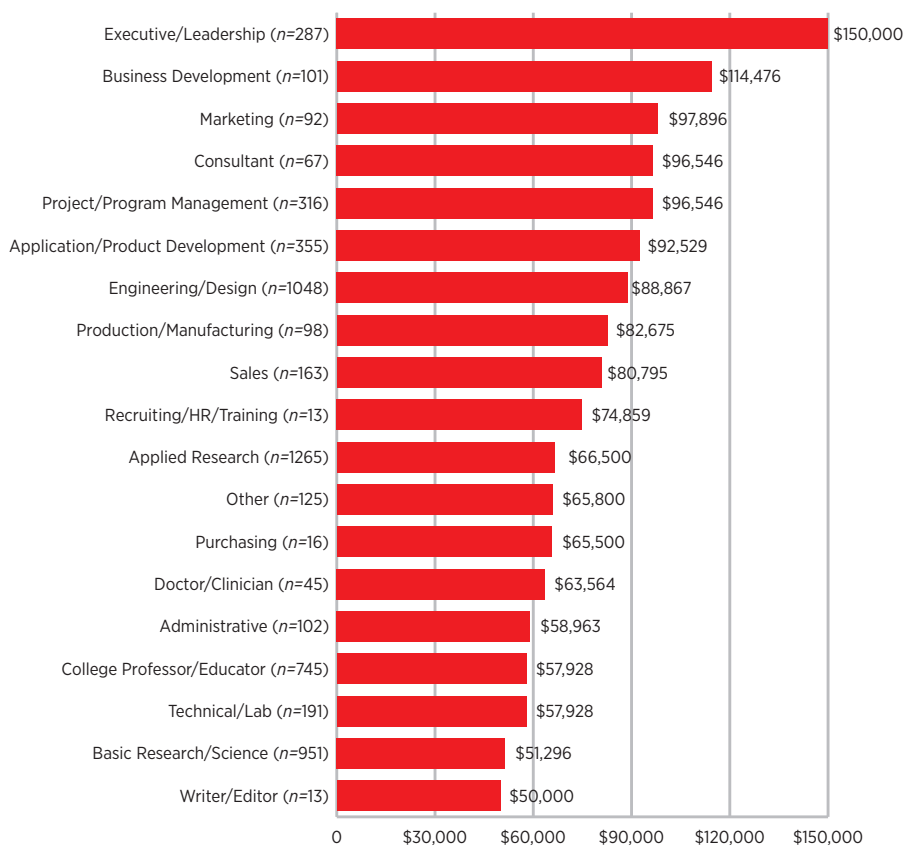
Other Factors

Other factors that influence salary include job level, job role, years employed, and size of organization. Top organizational leaders enjoy the highest salaries, while instructors and writers/editors anchor the bottom of the range.

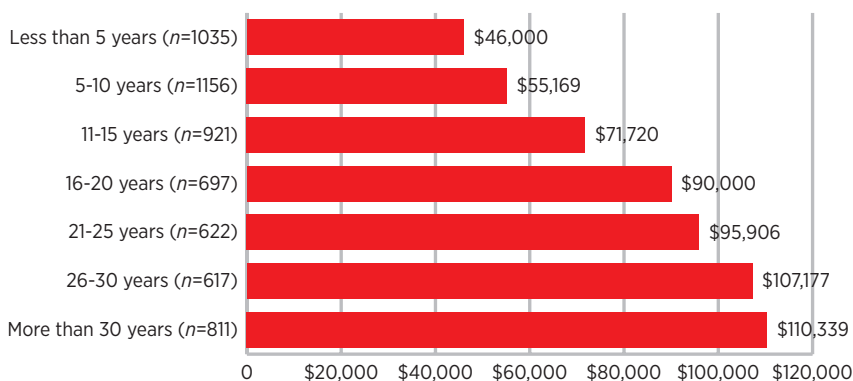
MEDIAN SALARY BY JOB LEVEL



MEDIAN SALARY BY JOB ROLE



MEDIAN SALARY BY YEARS EMPLOYED



Over 80% of respondents in Oceania and lower-income Asia expect raises in 2014 versus 48% in higher-income Europe.



Methodology and Footnotes

In February 2014, SPIE sent email survey invitations to a large subset of its global customer database. Response was voluntary and open. An iPad raffle and early access to this report were offered as incentives to encourage participation. Surveys were completed online using SurveyGizmo's enterprise survey tool. Results were filtered to yield 6,012 valid responses. 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.

FOOTNOTES:

1. U.S. dollars are used throughout. Local currencies were converted using March 2014 market exchange rates. Salary figures include total yearly compensation, both base pay and bonuses.
2. United States (2366), Peoples Republic of China (446), Germany (425), Japan (301), Italy (276), United Kingdom (275), France (235), Spain (181), Canada (170), Russia (165), South Korea (149), India (141), Taiwan (117), Netherlands (111), Switzerland (86), Australia (80), Israel (69), Mexico (68), Poland (64), Belgium (62), Brazil (60), Singapore (48), Turkey (40), Sweden (38), Chile (35), Romania (34), Ukraine (32), Portugal and South Africa (30), Malaysia (28), Colombia and Czech Republic (26), Austria and Greece (25), Hong Kong (24), Denmark and Finland (23), Lithuania (20), Algeria and Norway (19), Ireland and Slovenia (16), Egypt and Pakistan (15), Bulgaria, Saudi Arabia, and Thailand (13), Hungary (12), Estonia (11), Argentina and Slovakia (10), Indonesia and Nigeria (9), Latvia and Vietnam (6), Angola, Armenia, Azerbaijan, Iran, New Zealand, and Philippines (5), Bangladesh, Belarus, Cyprus, Oman, Serbia, and United Arab Emirates (4), Cameroon, Ethiopia, Iraq, and Venezuela (3), Croatia, Liberia, Libya, Malta, Qatar, Sudan, and Uzbekistan (2), Bolivia, Bosnia and Herzegovina, Costa Rica, Ecuador, Georgia, Jamaica, Kazakhstan, Kenya, Kuwait, Liechtenstein, Luxembourg, Macau, Macedonia, Moldova, Mongolia, Morocco, Mozambique, Namibia, Nepal, Panama, Peru, Tunisia, Yemen, Zambia, and Zimbabwe (1).
3. Australia and New Zealand.
4. Country population data are average annual wages per full-time and full-year equivalent employees in the total economy, 2012 USD exchange rates and constant prices, from http://stats.oecd.org/Index.aspx?DataSetCode=AV_AN_WAGE. Retrieved 4 April 2014.
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 Russia and Norway, at \$12,700 and \$98,860 per capita Gross National Income (GNI), respectively.

Higher- and lower-income subcategories are based on the World Bank's threshold for high-income countries, \$12,615 per capita GNI. 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 original wordings of responses to "How do you define success in your career?" were shortened to accommodate layout. Team success = The success of my team or work group; Scientific discovery = Advancing scientific discovery; Recognition = High level of recognition in my field (awards, reputation, invited speaking); Mentoring success = The success of people I have taught or mentored; Publishing = Publishing record; Contracts/grants = Winning contracts, grants, funding; Better world = Leaving the world a better place; Organization's success = Leading my organization to success; Pay = Amount of pay; Product innovation = Product innovation; Job promotion = Job promotion or rank.

Regions with sample sizes greater than 500 are included.

7. The category "for-profit" is composed of company/corporation and self-employed/consultant. "Academic" is composed of university/college and other research institute. "Government/military" is composed of government lab or research institute, civilian government, and military/defense.
8. Gene Russo, "Turbulent Times," *Nature*, August 2012, pp. 685-688.

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