

APPENDIX V – Employment, Salary, Census and Survey Data

1. American Chemical Society Employment Outlook
2. American Chemical Society Salary Trends
3. Chemical & Engineering News Chemistry Census Data
4. College of NSM Alumni Data

A recent employment outlook predicts a healthy growth and replacement rate for the next decade.

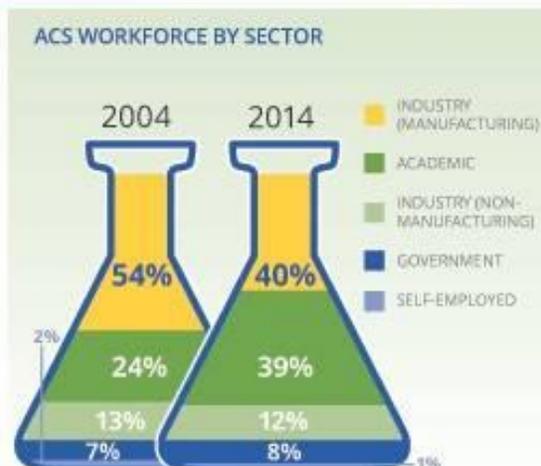
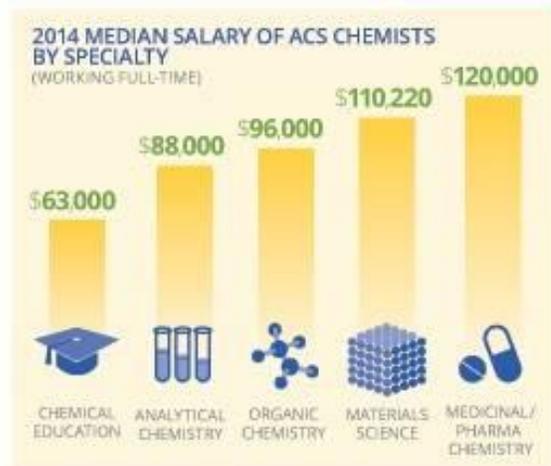
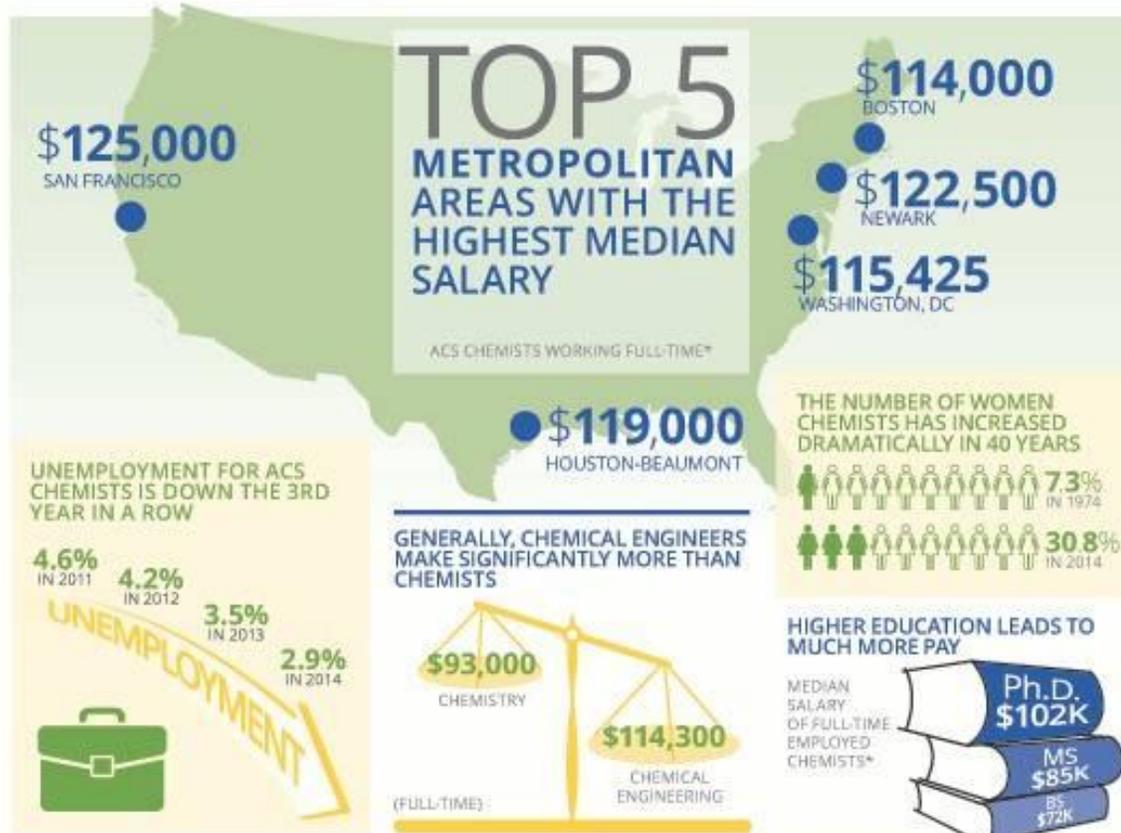
Title	Employment (in thousands)		Employment Change			Education, work experience, and training			
	2014	2024	Number (in thousands)	Percent	Job openings due to growth and replacement needs, 2014-2024 (in thousands)	2016 median annual wage	Typical entry-level education	Work experience in a related occupation	Typical on-the-job training
Atmospheric and space scientists ¹	11.8	12.9	1.1	9.2	3.3	92,460	Bachelor's degree	None	None
Biochemists and biophysicists ²	34.1	36.9	2.8	8.2	11.9	82,180	Doctoral or professional degree	None	None
Biological science teachers, postsecondary ³	64.3	74.8	10.4	16.2	21.8	76,650	Doctoral or professional degree	None	None
Biological technicians ⁴	79.3	83.5	4.1	5.2	26.3	42,520	Bachelor's degree	None	None
Chemistry teachers, postsecondary ⁵	26.6	30.7	4.1	15.4	8.8	76,750	Doctoral or professional degree	None	None
Chemists ⁶	91.1	93.5	2.4	2.6	22.4	73,740	Bachelor's degree	None	None
Geoscientists, except hydrologists and geographers ⁷	36.4	40.2	3.8	10.5	15	89,780	Bachelor's degree	None	None
Medical and clinical laboratory technologists ⁸	164.8	187.9	23.1	14	62.5	61,070	Bachelor's degree	None	None
Medical scientists, except epidemiologists ⁹	107.9	116.8	9	8.3	42.4	80,530	Doctoral or professional degree	None	None
Forensic science technicians ¹⁰	14.4	18.2	3.8	26.6	9.9	56,750	Bachelor's degree	None	Moderate-term on-the-job training

1 Atmospheric Chemist, Atmospheric Scientist, Climatologist, Space Scientist; 2 Biochemist, Biological Chemist, Biophysicist, Clinical Biochemist, Physical Biochemist; 3 Biochemistry Professor, Microbiology Professor; 4 Bacteriology Technician, Biochemistry Technician, Microbiology Technician; 5 Chemistry Professor, Inorganic Chemistry Professor, Organic Chemistry Professor, Physical Chemistry Professor, Phytochemistry Professor; 6 Agricultural Chemist, Analytical Chemist, Bench Chemist, Food Chemist, Formulary Chemist, Industrial Chemist, Inorganic Chemist, Laboratory Chemist, Nuclear Chemist, Organic Chemist, Quality Control Chemist, Research And Development Chemist; 7 Crystallographer, Geochemist, Geoscientist; 8 Biochemistry Technologist, Blood Bank Laboratory Technologist, Chief Medical Technologist, Clinical Laboratory Technologist, Cytogenetic Technologist, Cytologist, Cytotechnologist, Histologist Technologist, Histotechnologist, Immunohematologist, Pathology Laboratory Technologist, Tissue Technologist; 9 Cancer Researcher, Clinical Pharmacologist, Clinical Research Scientist, Gerontologist, Histologist, Histopathologist, Immunochemist, Industrial Pharmacist, Medical Health Researcher, Medical Research Scientist, Medical Scientist, Neuroscientist, Pharmacologist, Serologist, Toxicologist; 10 Ballistic Technician, Ballistics Expert, Crime Lab Technician, Crime Scene Technician, Criminalist Technician, Fingerprint Expert, Forensic Analyst, Forensic Science Technician, Trace Evidence Technician.



CHEMISTRY EMPLOYMENT 2014

DOMESTIC WORKFORCE BY THE NUMBERS



American Chemical Society

SOURCE: 2014 ACS Comprehensive Salary and Employment Survey. For more information, please contact research@acs.org.

* Excludes Chemical Engineers. Salaries of chemical engineers tend to be higher than chemists which may artificially inflate salaries.

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www.acs.org/CareerNavigator

ACS MEMBERS—THEN AND NOW

The **30TH ANNIVERSARY** of the ChemCensus salary survey shows what has changed—and what hasn't—about ACS members

ANDREA WIDENER AND LINDA WANG, C&EN WASHINGTON

THINK BACK TO 1985. Michael Jordan was NBA Rookie of the Year. Microsoft released its first version of Windows. “Back to the Future” was one of the top movies. Gas cost an average of \$1.09 per gal.

The year 1985 was also when the American Chemical Society started its ChemCensus. Although ACS does a smaller salary survey every year, ChemCensus is a comprehensive look at ACS members' demographics and earnings that's conducted every five years. That means it offers the most reliable data on the makeup of ACS—way more accurate than time travel via DeLorean.

To mark the 30th anniversary of ChemCensus, C&EN explored what ACS's membership looked like in 1985 compared with 2015. We interviewed two members who got their Ph.D.s in those years to get their perspective on how the job market

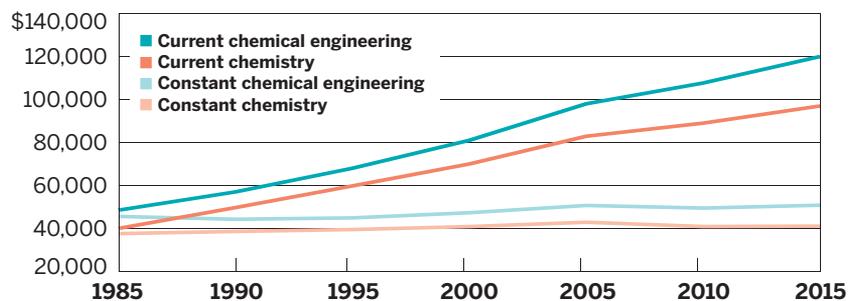
has changed (see page 32). We also present some of our top job advice from today's members (see page 33).

As the data show, the situation is not all roses for chemists. Salaries are up in real dollars, but if you take inflation into account, they have barely budged in 30 years. Unemployment is up from 1.7% in 1985 to 3.1% this year, which is high for chemists but still below the national average unemployment rate.

Still, there are bright spots, no matter how small. Diversity of ACS members by both race and sex is increasing. For example, women now make up more than 30% of members, double their representation 30 years ago. There are more African American, Hispanic, and Asian members, too.

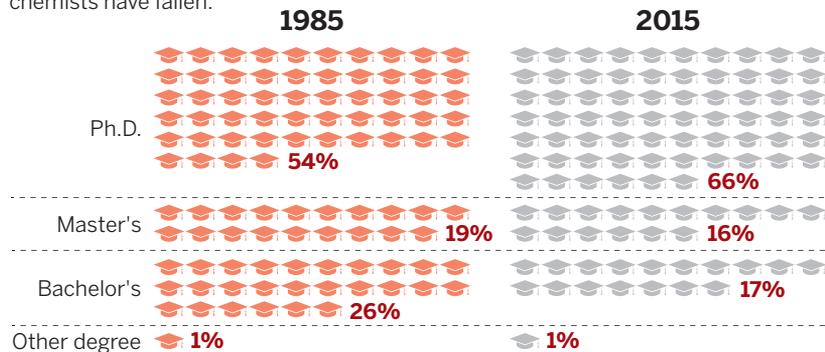
Sift through the data, and decide for yourself what the future might hold for the chemistry profession.

SALARY STAGNATION? If you take inflation into account, salaries for ACS members have barely budged over the past 30 years. This graph shows the rise in salaries in current dollars compared with salaries based on the value of the dollar 30 years ago.



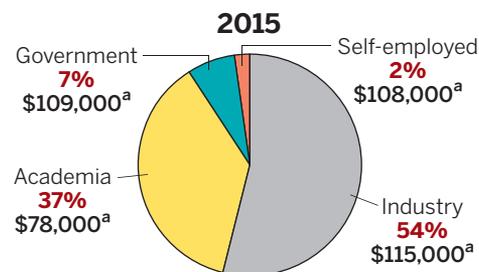
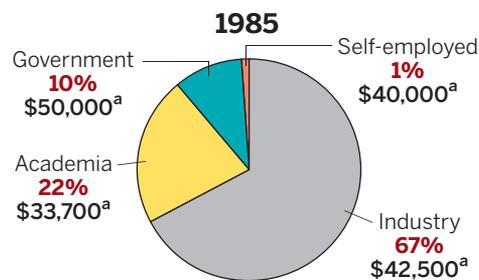
NOTE: Salaries in 1985 are based on 1984 constant dollars. Nonchemistry ACS members not included.

DOCTORS RISING The percentage of ACS members with Ph.D.s has risen more than 10% in the past 30 years. The shares of bachelor's and master's degree chemists have fallen.



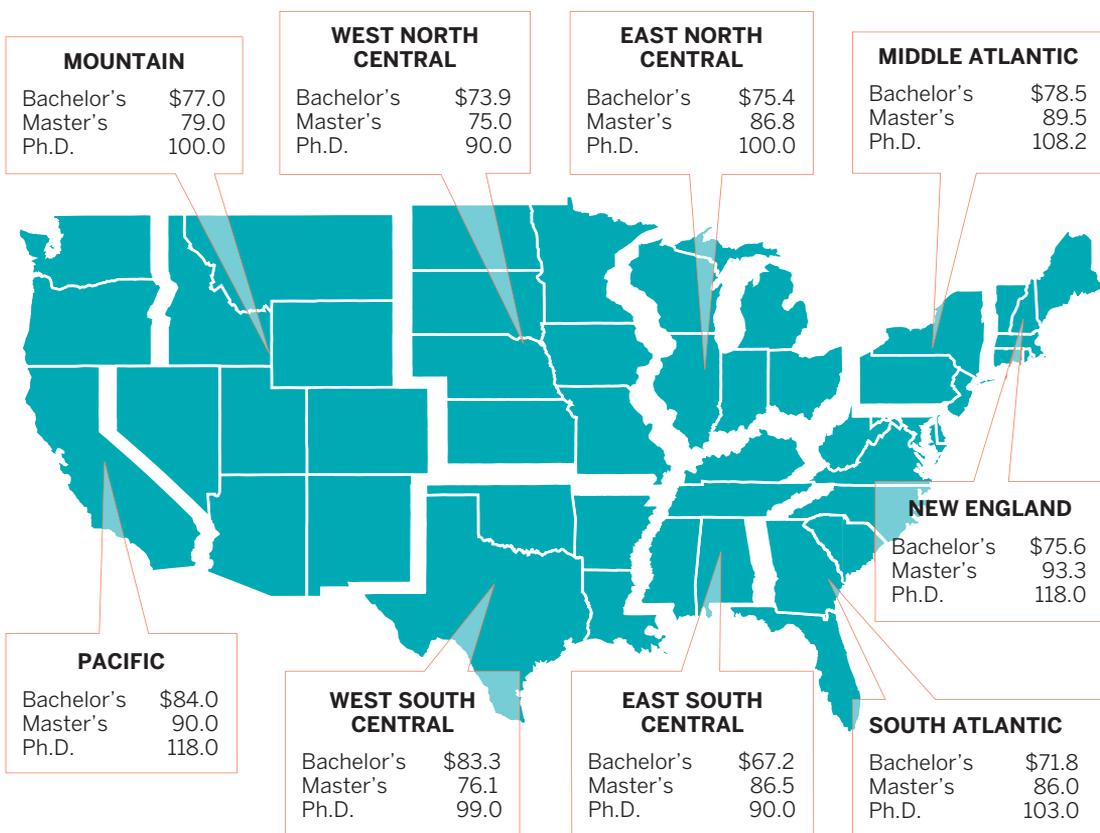
14% of members in 2015 had professional certifications, such as engineering or project management

UP WITH ACADEMIA More ACS members now come from academia than in 1985, but incomes in academia continue to lag behind those in industry and government.



^a Median salary for full-time employees in current dollars.

REGIONAL REFLECTIONS Chemists' salaries vary by region, with the most expensive parts of the country tending to have the highest salaries. The general trend of increasing salary with increasing education is constant through all areas. All salaries are given in thousands of dollars.



NOTE: Figures are median salaries for chemists who work full-time.

6% of female members in 2015 were employed part-time, compared with **3%** of male members

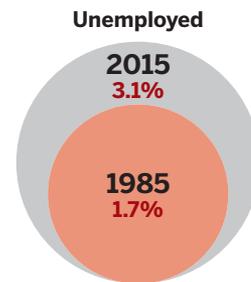
21% of members in 2015 said they do not have access to continuing education or technical training from their employer

2.4% of female members were working as postdocs in 2015, compared with **1.8%** of male members

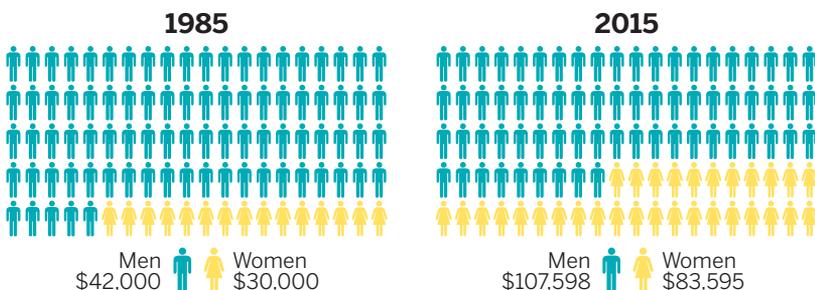
57% of members in 2015 used Web-based publications at least once a week to stay current in chemistry

11% of members in 2015 accepted a job that paid less than their previous position to maintain employment

UNEMPLOYMENT UP The percentage of ACS members seeking work has gone up and down over the past 30 years, but the current unemployment rate is almost double what it was in 1985.



STILL SEEKING PARITY The percentage of women ACS members has more than doubled in the past 30 years, but it's still significantly below 50%. The salary gap between men and women hasn't budged much either.



NOTE: Median salaries are in current dollars. The average age of women in ACS is lower than men's, which could confound this comparison. In 2015, the median age of male ACS members is 52 and female ACS members is 45. Each icon represents 1% of overall ACS membership.

SOURCE: ACS ChemCensus (all). In 1985, 42,613 members completed the survey. In 2015, 23,843 did.

DIVERSITY DETAILED The percentage of Asian, Hispanic, and African American ACS members has risen over the past 30 years.

	1985	2015 ^a
White	91.4%	83.8%
Asian	5.7%	10.2%
Black or African American	1.1%	2.4%
Hispanic	0.9%	4.0%
American Indian	0.1%	0.2%
Multiracial	na	1.8%
Other	0.8%	1.6%

^a Hispanic was measured as a separate category in 2015, and percentages will add up to more than 100%. na = not available.

DIFFERING PERSPECTIVES

TWO ACS MEMBERS—one who graduated this year, and one who graduated 30 years ago—reflect on prospects for chemists

SHAHRIAR MOBASHERY, UNIVERSITY OF CHICAGO, 1985

When Shahriar Mobashery got his Ph.D. from the University of Chicago in 1985, chemistry seemed like a great career choice.

“I thought the future was open,” the University of Notre Dame chemistry professor remembers. “In retrospect, that optimistic perspective was wonderful.”

Back then, graduate schools had a hard time keeping students from dropping out for high-powered jobs in industry. Even foreign students in need of visas were in high demand. “Everybody got jobs in the 1980s,” he remembers.

But the optimism that pervaded chemistry departments when Mobashery was in grad school has since dissipated. “Our outstanding students and postdocs still do just fine,” Mobashery says. But average students don’t fare nearly as well.

As the ACS ChemCensus shows, unemployment for chemists is higher today—3.1% in 2015 versus 1.7% in 1985. And when inflation is taken into account, the average salaries have been basically flat since Mobashery graduated.

But there are complex factors at play, he says. Globalization has pushed some jobs overseas, and there is less competition among companies to develop new products. Mobashery points to his own field—antibiotics—as an example. When he graduated in 1985 several dozen companies competed with each other to make new antimicrobials. Now, there are just a few.

But that doesn’t mean he’s not optimistic. The diversity of the field is in-

“I thought the future was open. ... Everybody got jobs in the 1980s.”



Mobashery

creasing, which suggests that chemistry is a welcoming place, Mobashery says. As the ChemCensus shows, ACS has become more diverse; the percentage of women is up from 15% in 1985 to 31% in 2015, and almost 20% are now from minority groups, up from less than 10% in 1985. “The trend is in the right direction,” he says.

More important, the research opportunities have never been better than they are today, Mobashery says. “If I were an assistant professor now, I could take my research in 100 different directions,” he says. “There are so many things one could do, it is mind-boggling.”

JENNY ZHANG, UNIVERSITY OF WASHINGTON, 2015

Jenny Zhang knows she was lucky to land her dream job after graduating earlier this year.

Zhang, who received a Ph.D. in chemistry from the University of Washington, is currently mixing her science background with business in a two-year global consultant training program at EMD Millipore, part of Merck KGaA. There, she is learning

how to be a management consultant while getting exposure to many different parts of EMD Millipore’s business. “I have always wanted to transition from the pure technology to more of a bridging position,” she says.

Early on, Zhang knew she wanted to go into industry, and she prepared by taking M.B.A. classes and doing business internships while she was



Zhang

“I see a lot of colleagues end up taking a job where I would expect they would end up in a better position.”

getting her Ph.D. But even then, “I was not clear if there was a job out there for me,” she says.

Not all of her fellow graduates have been able to find the job they’ve been searching for, Zhang says. They might be teaching part-time at the test-prep service Princeton Review or at a community college, doing computer programming, or carrying out a postdoc.

That picture fits with what the ACS ChemCensus data suggest about employment opportunities in 1985 and 2015. “It’s a lot harder to get hired with a Ph.D. in chemistry today,” she says.

“It is rare to hear about someone who finds a high-paying industry position or who goes directly into a tenure-track assistant professorship,” Zhang continues. “I see a lot of colleagues end up taking a job where I would expect they would end up in a better position.”

Now that she’s in industry, Zhang finds it’s harder to stay connected to ACS because many of the society’s events are held on university campuses or at national and regional meetings.

Zhang has seen for herself one of the trends pointed out by the ChemCensus data: The number of female chemists is increasing. Although just a few women hold top-level management positions, she says there are a good number in lower and middle management these days. Among her colleagues at the entry level, it’s about equal numbers of men and women. “You don’t really feel a gender difference.”—ANDREA WIDENER

FOTOSTUDIO MICHELS

BARBARA JOHNSTON

TIPS FOR THE JOB HUNT

EDITED BY LINDA WANG

“What’s the best piece of advice someone has ever given you about job hunting?” That’s what C&EN asked career fair attendees this past August during the American Chemical Society national meeting in Boston. We collected their answers as they were posing for a C&EN headshot—a professional photo to be used on LinkedIn and other career networking sites. Here are their headshots paired with what some of them had to say.

BOSTON CREATIVE HEADSHOTS (ALL)

“Keep networking, and maintain those relationships throughout the process.”

Melissa Cichowicz, chair, department of chemistry, West Chester University of Pennsylvania



“Consider every presentation you give to be a job interview. You never know who is listening.”

Sonja Francis, postdoc, Caltech



“Ask many questions! They’re interviewing you, but you are also interviewing them to see if the company is a right fit for you.”

Lisa Han, master’s candidate, Tufts University



“Be creative with the job hunt, and be yourself when you network.”

Sathish Munusamy, biologist, RNA Institute, University at Albany, SUNY



“Never stop looking, even when you have a job.”

Lukas Swanson, HPLC product specialist, Shimadzu Scientific Instruments



“Connect with recruiters on LinkedIn.”

Rebecca Weiner, Ph.D. candidate, Indiana University, Bloomington



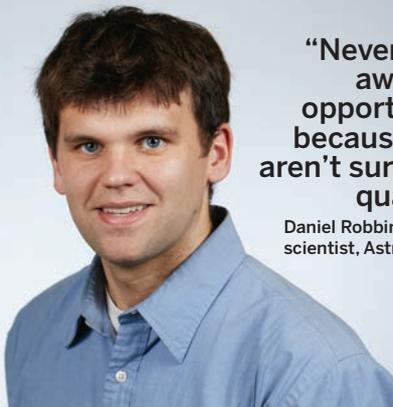
“Stay true to your values, and look for a company that matches them.”

Marianna Trujillo, master’s candidate, University of Calgary



“Never turn away an opportunity because you aren’t sure you qualify.”

Daniel Robbins, senior scientist, AstraZeneca



“Always speak to everyone you meet with a positive attitude.”

Elissa Grzincic, graduate research assistant, University of Illinois, Urbana-Champaign



WHERE HAVE THEY GONE?

UNDERGRADUATE BIOCHEMISTRY/CHEMISTRY

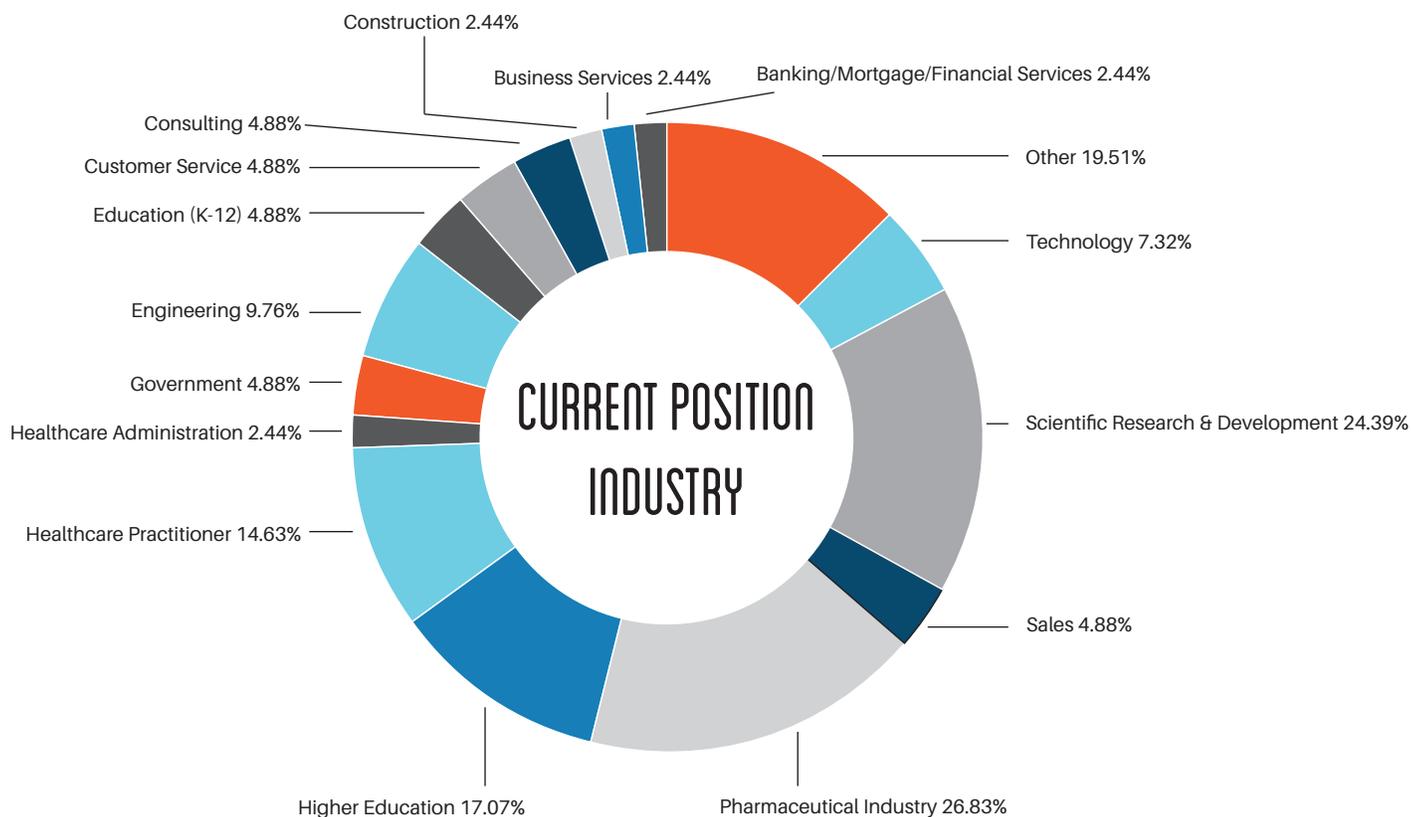
58 responses

1968-2015



Collected December 2015
via online survey

GRADUATION YEAR



CURRENT POSITION
INDUSTRY

JOB TITLES

Account Manager
Administrative Analyst
Chemist
Chief Technologist, Engineering
& Science Directorate
Clinical Research Consultant
Dentist
Director of California Operations
Engineer
Faculty

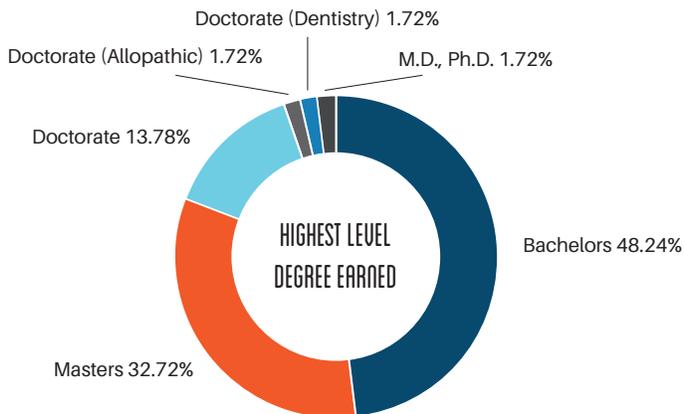
Head of Technology Infrastructure
Lab Technician
Licensing Intern
Manufacturing Associate
Operations Logistics West Coast Manager
Pharmacy Technician
Physical Scientist
Product Development Scientist
Program Coordinator

Physician
Quality Assurance (Director, Manager)
Regulatory Specialist
Senior Criminalist
Senior Examiner
System Development Engineer
Teacher
Tool Owner
Tutor

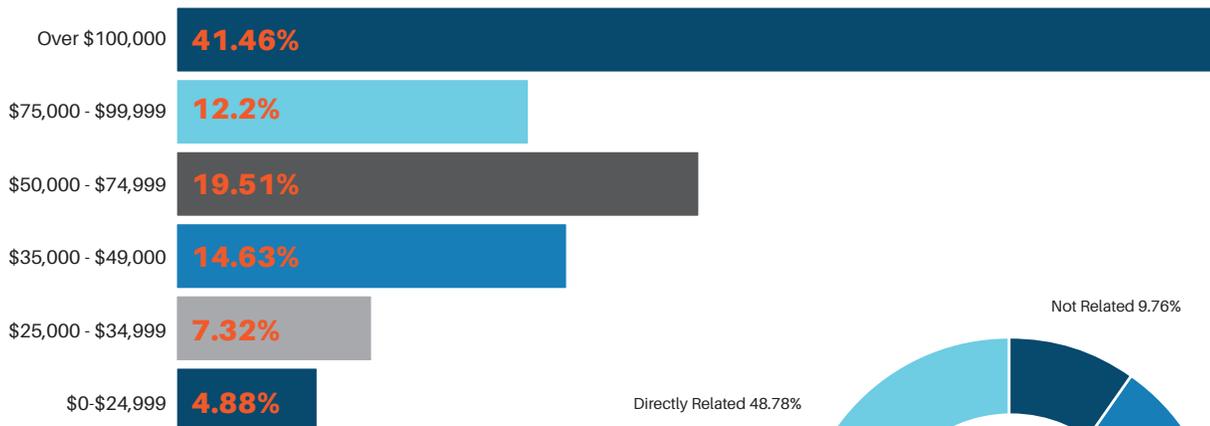
1968-2015 BIOCHEMISTRY/CHEMISTRY UNDERGRADUATES

EMPHASIS OF HIGHEST DEGREE EARNED

- | | |
|-------------------------|--------------------------|
| Analytical Chemistry | Environmental Management |
| Biochemistry | Forensic Chemistry |
| Biomedical Sciences | Food Science |
| Bio-Organic Chemistry | Hematology/Oncology |
| Business Administration | Industrial Pharmacy |
| Cell Biology | Medicine |
| Chemistry | Quality Assurance |
| Dentistry | Research & Applications |
| Education | Student Affairs |
| Environmental Chemistry | Theology |



WHAT IS YOUR INCOME?



EMPLOYERS

- | | |
|---------------------------------|---|
| Amgen | KaVo Kerr Group |
| Beachwood Medical | Keystone Learning Center |
| Children's Hospital Los Angeles | LA County Sheriff's Department, Crime Lab |
| Coast 2 Coast Environmental | Never Pharmaceuticals |
| Colleges | Peregrine Pharmaceuticals |
| Costco | Popchips |
| Cytosport, Inc. | Raytheon Company |
| Facility Solutions Group | Spectrum Labs |
| FBI | Takeda Pharmaceuticals USA |
| General Electric | Waters, Inc. |
| HP Inc. | Weill Cornell Medicine |
| IM Flash | Zef Scientific, Inc. |

