American Chemical Society

2006 STARTING SALARIES OF CHEMISTS AND CHEMICAL ENGINEERS

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of Chemists and Chemical Engineers

2006

Analysis of the American Chemical Society's
Survey of Graduates in Chemistry
and Chemical Engineering

Starting Salaries of Chemists and Chemical Engineers 2006

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Contents

Acknowledgements

For more than three decades, the American Chemical Society has prepared an annual survey of new graduates. This year, under the direction of the ACS Committee on Economic and Professional Affairs Subcommittee on Surveys, ACS performed the survey to determine trends in starting salaries and employment status of chemists and chemical engineers. This report presents the detailed results of the 2006 study. Summaries of the survey findings were published in an article appearing in the December 3, 2007 issue of *Chemical & Engineering News*, a copy of which appears as an appendix in this report.

The survey was conducted by Janel Kasper-Wolfe, Research Analyst, and Gareth Edwards, Program Associate. Gareth Edwards deserves special recognition for his outstanding work in analyzing the data and compiling the extensive set of appendices. Blake Stenning of Pittny Creative Services was instrumental in ensuring a consistent and attractive graphic layout and design. Eric Stewart was invaluable as the copyeditor, helping to ensure that this report is of the highest quality.

Jeffrey R. Allum, Ed.D.
ACS Research Manager

Summary of Findings

The *Starting Salaries of Chemists and Chemical Engineers: 2006* report documents employment characteristics for new graduates in these disciplines by looking at a number of factors, including mean and median starting salaries, current employment status, and plans for future education. The class of 2006 resembles graduates of the past several years in many respects. Distribution by gender and race/ethnicity remains more or less unchanged. Salaries and wages are mixed, however. Some of the highlights include the following:

- Salaries for recent undergraduates in chemistry and chemical engineering are rising, though only slightly. Salaries for master's level chemistry degree holders remained steady, but slipped among master's-level chemical engineers. Median and mean salaries of Ph.D. holders in both chemistry and chemical engineering either remained the same or dropped between 2005 and 2006. In some cases, the drop was significant.
- Factors influencing salaries include level of degree, amount of work experience, employment sector, region of the country, size of employer, and whether the student completed an ACS-certified program in chemistry.
- Ph.D.s in chemistry and chemical engineering reported median postdoctoral fellowships of $36,000 and $40,000 respectively in colleges and universities. The primary factor determining differences in postdoctorate median salary is the employment sector of the position.
- Approximately half of all chemistry bachelor's holders were pursuing higher education in the fall of 2006. Of these students, most were enrolled full time and many will remain in the field and study chemistry. About a quarter of chemical engineering B.S. recipients enrolled in graduate school. Most were working full time in permanent positions.

Salaries for the Class of 2006: Means and Medians

The class of 2006 in chemistry and chemical engineering reports higher salaries than last year in a variety of employment sectors, indicating a stable job market. Salaries varied only slightly depending on the type of employer, type of work, and employer size.

Starting salaries for recent chemistry graduates with less than a year of work experience were mixed in 2006. The mean, or average salary for inexperienced bachelor's recipients was $35,922, or 2.0% higher than the average starting salary in 2005. However, after adjusting for inflation, the 2006 average is 0.5% lower than the prior year. Master's and Ph.D. recipients in chemistry did not fare as well when compared to the 2005 graduating class. The increase in salary in current dollars was virtually zero for M.S. recipients with little or no work experience, and dropped by nearly 10% for chemistry Ph.D. recipients (representing declines of 2.2% and 11.8%, respectively, when adjusted for inflation). The 2006 average starting salary was $48,160 at the master's level and $62,541 at the doctorate level. As indicated in the starting salaries article in *C&EN* magazine, the decline may be attributed to falling response rates to the ACS survey. For instance, the 2006 survey captured only 74 Ph.D. graduates with full-time permanent employment and with less than 12 months of work experience.

TABLE 1. 2006 MEAN SALARIES FOR INEXPERIENCED CHEMISTRY GRADUATES (MEAN SALARY IN DOLLARS)

	Mean Salary 2005	Mean Salary 2006	%Change Current	%Change Constant
Bachelor's	$35,202	$35,922	2.0	-0.5
Master's	$48,002	$48,160	0.3	-2.2
Doctorate	$68,961	$62,541	-9.3	-11.8

TABLE 2. 2006 MEAN SALARIES FOR INEXPERIENCED CHEMICAL ENGINEERING GRADUATES (MEAN SALARY IN DOLLARS)

	Mean Salary 2005	Mean Salary 2006	%Change Current	%Change Constant
Bachelor's	$51,926	$54,034	4.1	1.6
Master's	$59,938	$57,661	-3.8	-6.3
Doctorate	$81,925	$77,248	-5.7	-8.2

Note: CPI 12/05 – 12/06 = 2.5%

For chemists with more experience, the results were very much the same. Mean salaries of chemists holding a bachelor's degree and having more than three years' experience rose from $42,568 to $45,156, a 6.1% increase. Salaries of chemists with master's degrees and more than three years' experience fell by nearly 2.0%, from $55,151 to $54,139. Ph.D. chemists with three years' experience fell by 8.4% from $68,525 to $62,741 in 2006.

Chemical engineering graduates also had mixed results. Inexperienced bachelor's recipients in chemical engineering earned 4.1% more in mean salaries in 2006 than 2005 (a gain of 1.6% after adjusting for inflation). Average starting salaries for B.S. chemical engineers was $54,034. Salaries for chemical engineers with master's and doctorates fell. Salaries of graduates with a master's degree in chemical engineering fell from $59,938 to to $57,661, a 3.8% decrease. The average annual starting salary for Ph.D.s with

Note: For the sake of brevity, this report will generally refer to holders of various degrees by the names of their highest degrees only, e.g., "bachelor's chemists," "master's recipients," or "Ph.D. chemical engineers."

less than a year's work experience was $77,248, a 5.7% decrease from 2005.

Bachelor's-level chemical engineering graduates with more than three years of experience saw a decline in salaries of nearly 24% compared with 2005, while master's-level chemical engineers had a negligible gain over the same period. A comparison of the salaries of doctoral level graduates between 2005 and 2006 cannot be made because of a lack of data in 2005. There is little evidence to explain with certainty why bachelor-level salaries dropped so much between 2005 and 2006. We can only speculate that some of the explanation may lie in the nature of the chemical engineering occupation. For instance, ACS member surveys have demonstrated substantial fluctuations in employment and salaries of chemical engineers, especially when compared to those of chemists, which tend to be more stable.

TABLE 3. 2006 MEDIAN SALARIES FOR ALL NEW GRADUATES EMPLOYED FULL TIME BY EXPERIENCE (MEDIAN SALARY IN DOLLARS)

	Chemistry			Chemical Engineering		
	B.A./B.S.	M.S.	Ph.D.	B.S.	M.S.	Ph.D.
Less than 12 months	$35,000	$47,362	$60,000	$55,769	$58,027	$78,000
12–36 months	$38,379	$54,508	$61,237	$55,603	$61,294	$84,644
More than 36 months	$43,666	$55,508	$54,157	$51,184	$61,083	$84,858

Mean salaries represent the calculated average starting salary. Because means can be influenced by a handful of very high or very low values, it is often helpful to consider the median, or middle value (50th percentile), in concert with the mean when evaluating typical salaries. The median is used as the primary descriptive statistic in the majority of this report to avoid the volatility inherent in the mean statistics.

Table 3 displays the median full-time salaries for new graduates by degree field, degree level, and number of months on the job. One would expect that as degree level and job tenure increases, salaries would also increase.

The median salaries of chemists with bachelor's degrees with less than one year of experience, one to three years' experience, and more than three years experience was $35,000, $38,379, and $43,666 respectively. All of these were improvements over the class of 2005. Chemists with a master's degree and less than one year of experience had a median salary of $47,362. Those with one to three years' experience reported a median salary of $54,508 and the more experienced master's holders reported salaries at $55,508. Median salaries of Ph.D. chemists tumbled from 2005 levels, regardless of their length of experience. Chemistry Ph.D.s who were at their job for less than a year had a median salary of $60,000 (a 16.7% drop from 2005), and Ph.D. chemists with more than three years' experience had a median salary of $54,157, also a 16.7% drop.

The pattern was different for chemical engineers. Chemical engineers holding a bachelor's degree with less than one year of experience enjoyed a median salary of $55,769 in 2006 – a 3.3% increase from the year before. More experienced B.S. chemical engineers did not fare as well; median salaries for those with one to three years' experience grew by only 0.4% from 2005. The salaries fell by 19.3% for bachelor's-level chemical engineers with more than three years' experience. Median salaries for inexperienced Ph.D.s went from $83,000 in 2005 to $78,000 in 2006, a 6% decrease. Median salaries of moderately experienced Ph.D.s grew by 4.5% between 2005 and

FIGURE 1. MEDIAN STARTING SALARIES FOR INEXPERIENCED CHEMISTS WORKING FULL TIME, 1975–2006 (IN CURRENT DOLLARS)

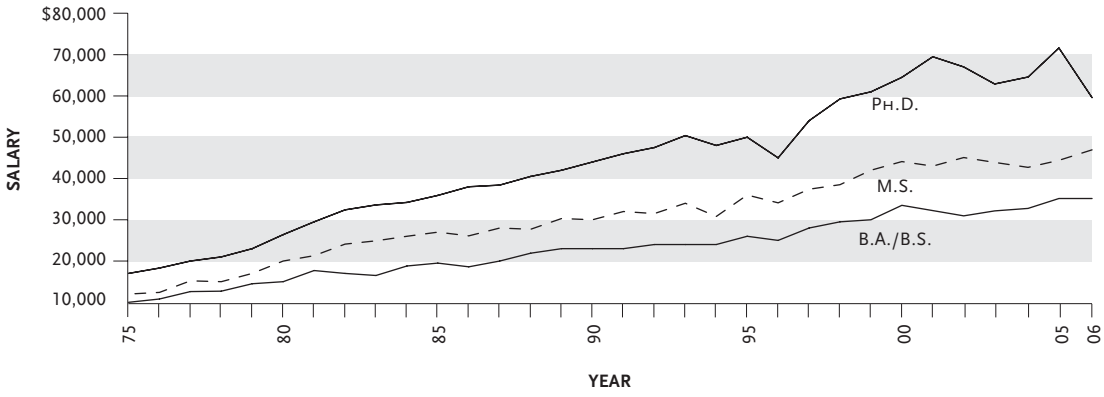


FIGURE 2. MEDIAN STARTING SALARIES FOR INEXPERIENCED CHEMICAL ENGINEERS WORKING FULL TIME, 1975–2006 (IN CURRENT DOLLARS)

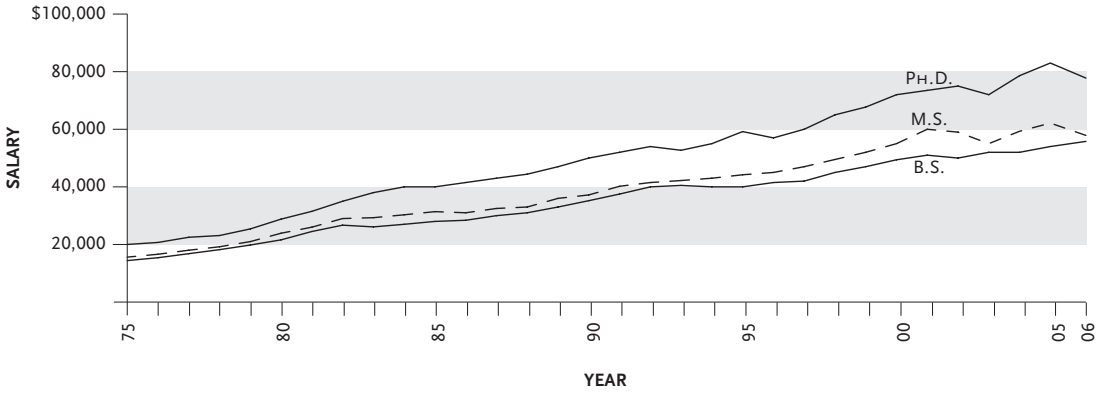


TABLE 4. MEDIAN STARTING SALARIES FOR INEXPERIENCED GRADUATES 1975 – 2006 (BY DEGREE AND IN 1,000S OF CURRENT DOLLARS)

	Chemistry			Chemical Engineering		
Year	B.A./B.S.	M.S.	Ph.D.	B.S.	M.S.	Ph.D.
1975	10.0	12.0	17.0	14.4	15.6	20.0
76	10.8	12.4	18.3	15.4	16.6	20.7
77	12.6	15.2	20.0	16.8	18.0	22.5
78	12.7	15.0	21.0	18.2	19.2	23.1
79	14.5	17.0	23.0	19.8	21.0	25.4
1980	15.0	20.0	26.4	21.6	23.9	28.8
81	17.7	21.3	29.5	24.5	26.0	31.5
82	17.0	24.1	32.4	26.7	29.0	35.0
83	16.5	24.9	33.6	26.1	29.3	38.0
84	18.8	26.0	34.2	27.0	30.3	40.0
1985	19.5	27.0	35.9	28.0	31.4	40.0
86	18.6	26.1	38.0	28.4	31.0	41.5
87	20.0	28.0	38.4	30.0	32.5	43.0
88	21.9	27.7	40.5	31.0	33.0	44.4
89	23.0	30.3	42.0	33.0	36.0	47.0
1990	23.0	30.0	44.0	35.2	37.2	50.0
91	23.0	32.0	46.0	37.5	40.2	52.0
92	24.0	31.5	47.5	40.0	41.5	54.0
93	24.0	34.0	50.4	40.5	42.2	52.7
94	24.0	30.8	48.0	NA	NA	NA
1995	25.0	36.0	50.0	40.0	44.2	59.2
96	25.0	34.1	45.0	41.5	45.0	57.0
97	28.0	37.5	54.0	42.0	47.0	60.0
98	29.5	38.5	59.3	45.0	49.8	65.0
99	30.0	42.0	61.0	47.0	52.0	67.7
2000	34.3	44.1	64.5	49.4	55.0	72.0
01	32.2	43.0	69.5	51.0	60.0	73.5
02	31.0	45.0	67.0	50.0	59.0	75.0
03	32.0	44.5	63.3	52.0	55.0	72.0
04	32.6	43.3	65.0	52.0	59.3	78.6
2005	35.0	45.0	72.0	54.0	62.2	83.0
06	35.0	47.4	60.0	55.8	58.0	78.0

2006. Data from experienced Ph.D. chemical engineers was not available in 2005, but the 2006 median salary was $84,858.

Because the ACS starting salary survey focuses mainly on collecting data from chemistry graduates, the chemical engineering statistics are generated by a small number of responses. As such, data regarding chemical engineers should be interpreted with caution. The figures for chemical engineers do, however, show great reliability when compared to data from past years. In general, it is clear that pay for those earning degrees in chemical engineering is higher than that of those earning degrees in chemistry. Holders of bachelor's degrees in chemistry with less than one year of experience typically earned about $36,000 compared to about $54,000 for those with bachelor's degrees in chemical engineering. Chemical engineers with Ph.D.s earned 30% more than chemists with Ph.D.s in 2006, which is consistent with past data.

The table and graphs on this and the preceding page show the median starting salaries by level of degree for chemists (Figure 1) and chemical engineers (Figure 2) over the past 31 years. Starting salaries were the same in 2006 and 2005 for B.S.-level chemists. M.S.-level chemists enjoyed a modest increase, while Ph.D.-level chemist salaries declined substantially. Even so, a master's-level chemistry graduate can expect to earn about one-quarter less than a Ph.D. in the same field, or $47,362.

Starting salaries for B.S.-level chemical engineers rose again in 2006. Starting salaries for M.S.- and Ph.D.-level chemical engineers fell, however. Despite the drop in salary, Ph.D.s still earn considerably more than M.S. and B.S. chemical engineers. The median starting salary for Ph.D. chemical engineers was $78,000 in 2006 – about one-third higher than the master's starting salary of $58,027.

With the exception of Ph.D. chemists and chemical engineers and M.S. chemical engineers, 2006 salaries were as high as they have ever been. When evaluating these trends, it is important to consider not just the current dollar increase, but whether the increase is greater than inflation. Rises above the inflation rate are the only increases that indicate real growth.

Tables 5 and 6 provide summary statistics for starting salaries of chemistry and chemical engineering graduates in the last two years. This display allows for a direct comparison of the distribution of salaries by degree level between the last two years. For the most part, the mean is very close to the median (50th percentile) for all degree levels. This indicates a normal distribution of salaries with few outliers.

Table 5 compares salary ranges grouped in percentiles for each type of degree for 2005 and 2006 chemistry graduates. By displaying the 10th and 90th percentiles, we get a better idea of the full range of salary offers accepted. For chemistry bachelor's, 80% of full-time starting salaries fell between $25,632 and $48,000. This is virtually identical to the 2005 range. Most master's recipient salaries ranged between $32,829 and $60,877, while the corresponding majority of Ph.D.s' salaries ranged from $38,991 to $86,807. As degree level increases, salary increases. With an increase in average salary comes a larger range of salaries. It is important to note that

TABLE 5. RANGES OF STARTING SALARIES OF INEXPERIENCED FULL-TIME EMPLOYED CHEMISTRY GRADUATES BY DEGREE: 2005 AND 2006 (IN DOLLARS)

	Bachelor's		Master's		Ph.D.	
Salaries	2005	2006	2005	2006	2005	2006
90th Percentile	47,060	48,000	62,920	60,877	90,000	86,807
75th Percentile	41,000	40,000	58,306	57,654	81,204	80,000
50th Percentile	35,000	35,000	45,000	47,362	72,019	60,000
25th Percentile	28,855	30,000	38,063	42,000	55,000	44,662
10th Percentile	24,000	25,632	33,661	32,829	44,792	38,991
Mean	35,502	35,922	48,002	48,160	68,961	62,541
Count	354	355	54	42	65	74
Standard Deviation	9,155	9,444	12,624	10,593	16,760	19,249

while the salary range between the 90th and 10th percentiles is only $22,368 for bachelor's and is $47,816 for Ph.D.s, these differences are proportionate to the typical salary.

The full range of chemical engineering starting salaries for 2005 and 2006 appear in Table 6. The average salary for recent chemical engineering B.S. chemical engineering graduates was $54,034, and 80% of salaries fell in the range between $38,880 and $64,957. M.S. chemical engineering graduates averaged $57,661 and most salaries were between $30,000 and $79,000. Chemical engineering Ph.D. salaries were generally in the range of $50,988 and $97,178. The average starting salaries for inexperienced full-time Ph.D. chemical engineers was $77,248.

Again, starting salaries for chemical engineers are higher than for chemists at all levels. Typically, this survey has found that salary ranges for chemical engineers are smaller than those of chemists. This was generally true in 2006, with the exception of master's-level chemical engineering, which had a particularly low 10th percentile. This may be explained as a consequence of a small number of chemical engineers participating in the survey. Setting this anomaly aside, it can be argued that chemical engineers may be more homogeneous in terms of salary distribution when compared to chemists.

TABLE 6. RANGES OF STARTING SALARIES OF INEXPERIENCED FULL-TIME EMPLOYED CHEMICAL ENGINEERING GRADUATES BY DEGREE: 2005 AND 2006 (IN DOLLARS)

	Bachelor's		Master's		Ph.D.	
Salaries	2005	2006	2005	2006	2005	2006
90th Percentile	60,565	64,957	71,173	79,000	95,600	97,178
75th Percentile	57,866	60,000	68,370	70,211	84,000	87,838
50th Percentile	54,000	55,769	62,150	58,027	78,600	78,000
25th Percentile	47,500	49,310	54,707	50,545	70,800	65,470
10th Percentile	40,000	38,880	46,349	30,000	61,600	50,988
Mean	51,926	54,034	59,938	57,661	77,419	77,248
Count	112	121	26	10	27	22
Standard Deviation	8,699	11,105	10,079	14,899	12,005	18,165

SALARY FACTORS The data displayed in Tables 5 and 6 suggest that even if we hold experience and level of degree constant, there are a wide range of salaries reported by recent graduates just beginning their careers. Larger ranges may be attributed to a variety of factors, including region of the country, type of employer, the nature of the work, as well as characteristics of the applicant him or herself. The tables in the appendix compare the average salaries for some of these factors. For instance, those employed in private industries typically earned more than those working in academia (Appendix Tables A–5 and A–15).

The type of employer and the product it produces also has a bearing on salary (Appendix Tables A–8 and A–17). The median annual income for bachelor's-level chemists was $35,000. Bachelor's-level chemists working in private utilities, professional services, and specialty chemicals would expect to earn far more. The same holds true for chemical engineers. For instance, recent bachelor's-level chemical engineering graduates employed in the pharmaceuticals industry earned $59,205 compared to the overall median of $57,973. Similarly, master's level chemical engineers reported $56,627 in the pharmaceutical industry. As a general rule, undergraduate chemical engineers working in soaps and detergents, other non-manufacturing, petroleum, electronics, and basic chemicals enjoyed higher median salaries. Bachelor's-level chemical engineers working in personal care, other manufacturing, biochemical products, contract research, and laboratories tended to have lower median salaries.

The size of employer (Appendix Tables A–9 and A–18) is also relevant to earnings. Small businesses with fewer than 50 employees tend to offer lower average salaries than larger corporations and universities. Bachelor's-level chemists, for example, earn a median salary of $35,000. They earn less than the median salary if they work for an employer with fewer than 2,500 employees. The same holds true for chemical engineers. For instance, the median salary for bachelor's-level chemical engineers was $42,000 when there were fewer than 50 employees. By comparison, bachelor's-level chemical engineers working for employers with a workforce of 2,000 or more could expect median salaries near $60,000.

Salaries of new graduates also appear to change according to geographic region (Appendix Tables A–11 and A–20). Bachelor's-level chemists working in the East North Central, Middle Atlantic, and New England enjoyed higher median salaries than their peers in other parts of the U.S. Bachelor's-level chemical engineers reflect a different trend. Those working in the Mountain, West South Central, East North Central, and Pacific regions enjoyed higher median salaries than their peers in other parts of the country.

Employee characteristics contributing to starting salary may include primary job duties (Appendix Tables A–10 and A–19), degree specialization

(Appendix Table A–13), and whether or not the individual has received certification (Appendix Table A–12). Those who teach typically earn less than those engaged in development and management. This is especially true of Ph.D. chemists, who can earn far more in professions other than teaching. With respect to specialties, graduates specializing in physical and inorganic chemistry averaged salaries much higher than in other fields. A B.S.-level chemistry graduate with a specialty in physical chemistry, for example, can expect to earn a median salary of $48,819 compared to the $35,000 average. Chemists holding Ph.D.s with specializations in medicine/pharmaceutical, organic, or polymer chemistry can expect to enjoy particularly high annual earnings. Ph.D. specialists in chemical education, materials science, and inorganic chemistry can expect to earn far less. There appears to be little overall difference between inexperienced chemists with and without certification. As shown in Table A-12, there was no difference in the median income between the inexperienced with and without certifications. In terms of the mean income, those with certification earned slightly more.

There were three industry categories in which bachelor-level graduates with certification earned more than those without (other academic, manufacturing, and federal government). There were five employment categories where non-certified bachelor's-level chemists earned more than certified ACS chemists (college-university, medical school, non-manufacturing, military, and other government).

It is difficult to make conclusions about the impact that certification has on the salaries of inexperienced, bachelor's-level chemists based upon these data. They reflect the opinions of only 328 total individuals, only about 12% of the total responses. The findings do differ from the past three years (2003-2005), during which median and mean salaries of certified bachelor-level chemists were higher than non-certified bachelor's-level chemists. It is a trend worth following in the future.

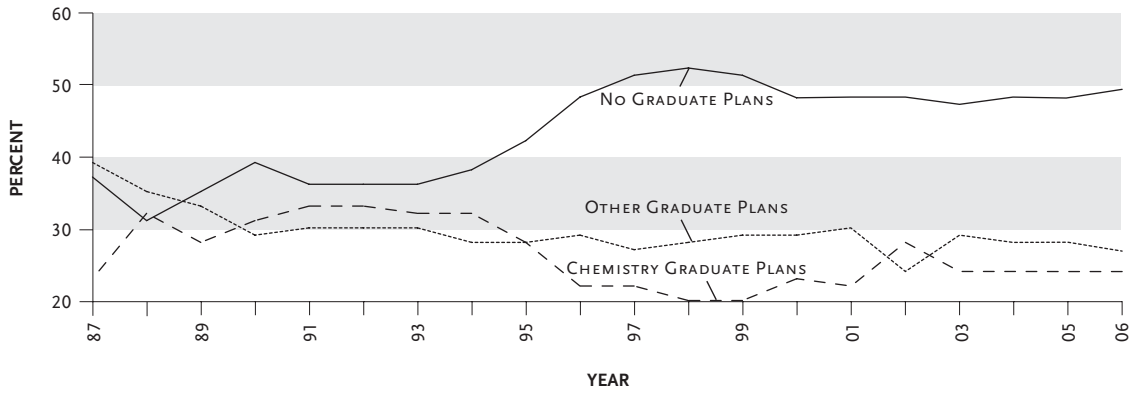
Another important comparison in salary differences is between men and women. Because degree level and type of employer are determining factors of starting salary, Appendix Tables A–15 and A–16 show the starting salaries of men only and women only within these subcategories. However, by breaking down the salaries to such a specific level of detail, we lose some power in making comparisons, as the number of respondents in each category is small. That being said, in some employment sectors and degree levels there are small differences between men and women. This is likely attributable to some other factor such as type of work, number of employees, or geographic area. It remains important to evaluate men's and women's salaries each year and to investigate when and where differences emerge.

GRADUATE AND POSTDOCTORAL STIPENDS

As reported in last year's survey, graduate and postdoctoral stipends remain relatively stagnant. Across all degree levels and fields of study, median stipends increased only modestly over last year's reported stipends (Appendix Table A–21). Bachelor's and master's stipends were about the same ($21,600 for B.S. chemistry, $24,000 for B.S. chemical engineering, and $22,314 for M.S. chemistry). Ph.D.s in chemistry and chemical engineering reported median postdoctoral fellowships of $36,000 and $40,000, respectively. Stipends were the same as 2005 for chemistry, but almost $4,300 more than 2005 for chemical engineers.

Not surprisingly, graduate support was reported most often by those working in academia. Some chemists and chemical engineers employed by private industry receive stipends. These stipends tend to be higher than the average. Several Ph.D. chemists and chemical engineers reported being employed by the federal government under stipend arrangements. Few, if any, B.S. and M.S. chemists and chemical engineers were under similar arrangements with the federal government.

FIGURE 3. POST-GRADUATION PLANS OF BACHELOR'S CHEMISTRY GRADUATES: 1987–2006

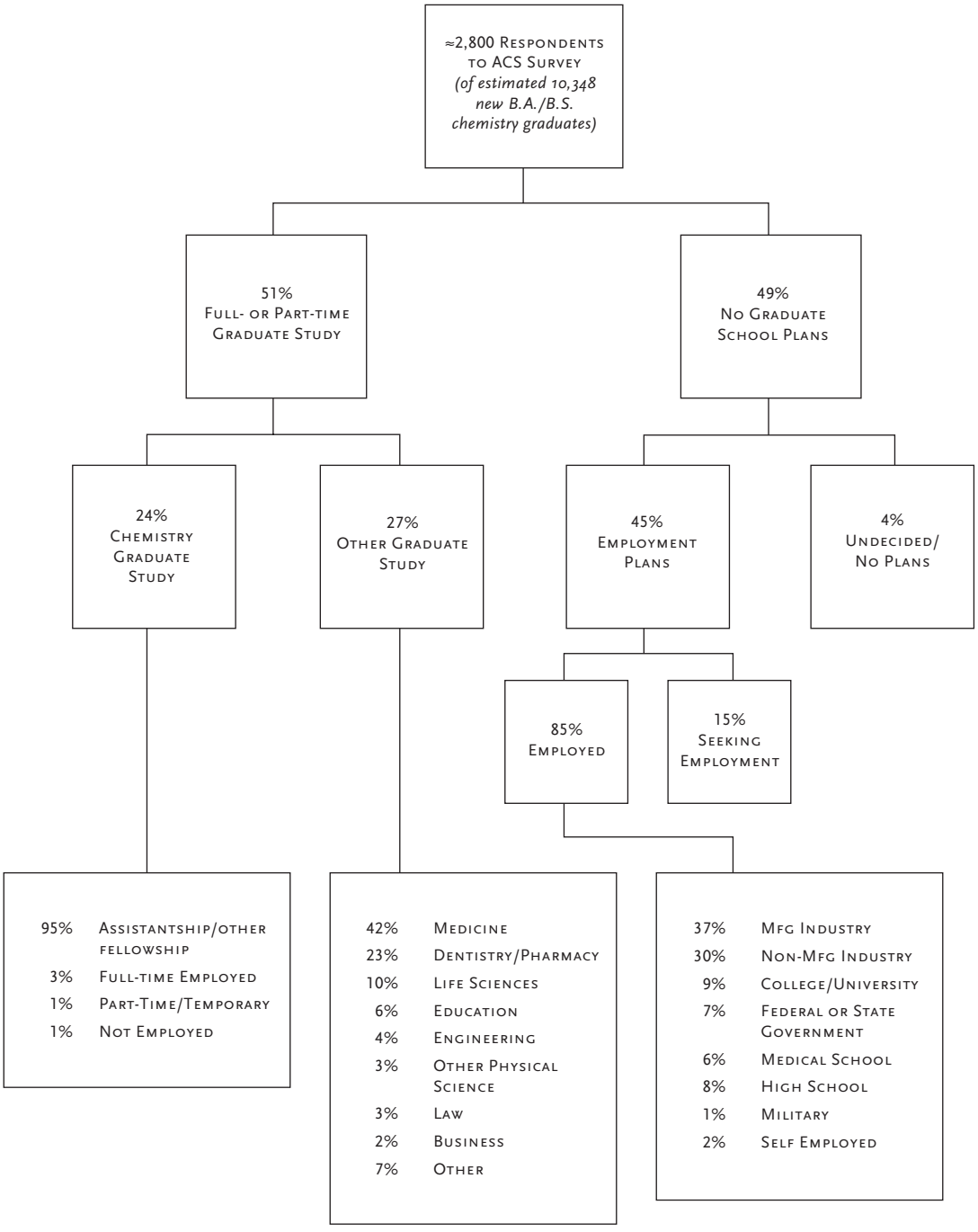


POST-GRADUATION PLANS OF BACHELOR'S CHEMISTRY GRADUATES

While starting salaries provide a view of how recent chemistry and chemical engineering graduates are doing in academic, government, and industrial sectors, it is important to note that a substantial number of recent college graduates plan to remain out of the workforce to continue their education.

Approximately one-half of chemistry bachelor's plan to attend graduate school. As Figure 3 shows, the proportion of students pursuing graduate

FIGURE 4. POST-GRADUATION PLANS OF 2006 BACHELOR'S CHEMISTRY GRADUATES



degrees in chemistry has held steady at about 25%, while a slightly higher percentage is choosing to pursue graduate degrees in other fields. In fact, for most of the past decade, more graduates have chosen to pursue advanced studies in fields other than chemistry. Those bachelor-level graduates with no plans for graduate studies remains at about 50%.

A detailed breakdown of the plans of the undergraduate class of 2006 is shown in Figure 4. Of the 49% of B.S.-level chemists with no plans for graduate school, most had employment plans, and only a small number were undecided.

TABLE 7. PLANS FOR FURTHER STUDY OF BACHELOR'S CHEMISTRY & CHEMICAL ENGINEERING GRADUATES: FALL 2006

Plans	Chemistry	Chemical Engineering
Total further studies		
Full time	47.1%	23.7%
Part time	3.5%	3.6%
No plans for further studies	49.4%	72.7%
Total*	100.0%	100.0%
Number of responses	1,841	302

**Note: Any deviation from 100 is due to rounding.*

Of all survey respondents, 24% plan to continue their studies in the field of chemistry. Most of these students (95%) will receive support through assistantships or other fellowships, and a small number will also work to help pay for their education. The remaining graduates will pursue degrees in disciplines other than chemistry. Medicine (42%), dentistry and pharmacy (23%), and life sciences (10%) were the most common fields of study. Smaller percentages of undergraduate chemists are pursuing studies in business (2%), education (6%), law (3%), or other physical science (3%).

PLANS FOR ADVANCED STUDY

A breakdown of chemistry and chemical engineering bachelor's graduate school plans is presented in Table 7. Almost half of all recent chemistry bachelor's recipients were enrolled in graduate school full time in the fall of 2006. An additional 3.5% participated in a part-time program. These numbers are highly consistent with 2005 data, indicating a stable trend.

Chemical engineering graduates, on the other hand, are far less likely to continue their education, which is consistent with past years. Nearly three-quarters (72.7%) of chemical engineering graduates have no plans for further studies. It is possible that competitive salaries in chemical engineering may be pulling these graduates into permanent employment.

Undergraduate chemistry graduates who decide to continue their education tend to remain within the field of their undergraduate degrees. A little less than half (47.5%) of chemistry undergraduates continuing full-time graduate programs study chemistry. An undergraduate degree in chemistry also appears to provide an ample background for those who want to enter medical school: about one-third of these full-time students decided to pursue medicine, dentistry, or pharmaceutical science.

TABLE 8. FIELDS OF STUDY OF CHEMISTRY AND CHEMICAL ENGINEERING B.A./B.S. GRADUATES: FALL 2006

Plans	Chemistry	Chemical Engineering
Full-time study		
Chemistry or biochemistry	47.5%	16.2%
Chemical or biochemical engineering	1.3%	45.4%
Other engineering	0.3%	4.0%
Physical science	2.3%	2.4%
Life science	2.6%	3.2%
Medicine, dentistry, or pharmacy	33.0%	14.6%
Business or management	0.8%	0.0%
Education	2.0%	0.0%
Law	1.0%	5.3%
All others	9.2%	8.9%
Total*	100.0%	100.0%
Number of responses	864	71
Part-time study		
Chemistry or biochemistry	45.2%	29.0%
Chemical or biochemical engineering	1.8%	10.5%
Other engineering	1.8%	10.5%
Physical science	5.9%	0.0%
Life science	6.4%	0.0%
Medicine, dentistry, or pharmacy	9.6%	10.5%
Business or management	3.7%	28.9%
Education	15.1%	10.5%
Law	1.8%	0.0%
All others	8.7%	0.0%
Total*	100.0%	100.0%

**Note: Any deviation from 100 is due to rounding.*

Chemical engineering undergraduates are more diverse in their choice of full-time graduate programs. Of those bachelor's-level chemical engineers who do decide to pursue higher education, chemical and biochemical engineering is the degree of choice. Nearly one-half (45.4%) of B.S. level chemical engineers are pursuing full-time education in this field. Chemistry, biochemistry, medical, dental, and pharmaceutical specialties are also popular among holders of bachelor's degrees in chemical engineering.

Part-time graduate students exhibit different characteristics than full-time students. These students are typically employed and their goals may be more career-oriented than academic. Most bachelor's-level chemists who pursue a graduate degree part time remain in the field. About one in ten (9.6%) enter medical school, while 6.4% choose to pursue life science studies. A comparatively robust 15.1% are pursuing advanced studies in education. Only a minority of chemistry graduates pursue part-time education in fields outside of the physical sciences, medicine, business, education, and law.

Chemical engineers resemble chemists in some respects. Of those who are part-time students, nearly one-third (29.0%) were studying chemistry or biochemistry, while another 28.9% were studying business. Equal percentages (10.5% each) of bachelor's-level chemical engineers were pursuing degrees in chemical or biochemical engineering, other engineering, medicine, dentistry, or pharmacy, and education. None of the B.S.-level chemical engineering graduates responding to the survey were studying in other fields. In this respect, young chemical engineers studying on a part-time basis appear to be somewhat more homogenous than their chemist peers.

POST-GRADUATION EMPLOYMENT STATUS

As illustrated in Table 7, about half of chemistry bachelor's recipients (47.1%) continued their education full time, while only about a quarter of college graduates in chemical engineering (23.7%) did so. Table 9 illustrates the work and employment status of those with advanced degrees. Nearly one-third (29.4%) of recent bachelor's recipients in chemistry had found permanent full-time employment by October 1, 2006. About 9% worked temporary full-time jobs and 4.4% had part-time work. Most of the part-time employed chemists were working part time at a temporary job.

Many chemistry master's graduates surveyed had no plans to continue their education. Just under half were employed full time (41.7% in permanent and 8.2% in temporary positions), 5.4% part time, and 34.5% remained enrolled in graduate programs. More than one-half of chemistry doctorates (52.3%) found postdoctoral appointments, and about one-third (32.3%) found full-time permanent employment. Only 4.4% found temporary full-time employment. Very few (2.1%) worked part time. These figures were similar to those of the class of 2005.

In general, chemical engineers were more likely than chemists to find full-time permanent employment. At all degree levels, between 55.0% and 64.1% of graduates found full-time permanent work, a rate virtually double that of chemists. A smaller percentage of bachelor's-level chemical engineers were pursuing graduate studies or postdoctoral experiences. Virtually none were employed part time. This is perhaps another indicator of the strong employment opportunities for chemical engineers.

Unemployment is defined by this survey as the proportion of graduates who did not have a job and were seeking work. The unemployment rate for chemists at the bachelor's level was 6.0%. For master's level chemists, the unemployment rate 6.4%, and for doctorates, the unemployment rate was 6.2%. Unemployment rates for bachelor's, master's, and doctoral-level chemical engineers were 6.4%, 2.2%, and 2.9% respectively.

TABLE 9. POSTGRADUATION STATUS OF CHEMISTRY AND CHEMICAL ENGINEERING GRADUATES: OCTOBER 1, 2006

Major and Employment Status	Bachelor's	Master's	Ph.D.
CHEMISTRY			
Full-time employed			
Permanent	29.4%	41.7%	32.3%
Temporary	9.2%	8.2%	4.4%
Part-time employed			
Permanent	0.6%	0.4%	0.9%
Temporary	3.8%	5.0%	1.2%
Graduate student, postdoc	47.3%	34.5%	52.3%
Unemployed and seeking employment	6.0%	6.4%	6.2%
Unemployed and not seeking employment	3.7%	4.0%	2.7%
TOTAL*	100.0%	100.0%	100.0%
Number of responses	1,834241	337	
CHEMICAL ENGINEERING			
Full-time employed			
Permanent	61.0%	55.5%	64.1%
Temporary	4.3%	8.8%	0.0%
Part-time employed			
Permanent	0.3%	0.0%	0.0%
Temporary	1.3%	0.0%	0.0%
Graduate student, postdoc	24.0%	31.4%	33.0%
Unemployed and seeking employment	6.4%	2.2%	2.9%
Unemployed and not seeking employment	2.7%	2.2%	0.0%
Total*	100.0%	100.0%	100.1%
Number of responses	297	40	60
Unemployment as of 10/1/2006	8.9%	6.2%	9.1%

**Note: Any deviation from 100 is due to rounding.*

Unemployment estimates should be interpreted with caution, as the ACS data are based on a relatively small portion of all graduates. A rate of less than 10% is highly susceptible to fluctuations when the respondent pool is so small. It is also possible that unemployed graduates were disproportionately represented among the survey respondents. Another factor that may impact the unemployment rate measured here is the date of data collection. Graduates were asked to report on their employment status as of the first week of October 2006. Given that this survey is administered several months after graduation, it is possible that many of the unemployed degree recipients eventually found employment. Most of these individuals were not working prior to graduation and it is likely that a number of them will simply need more time to find work.

BACHELOR'S GRADUATES CERTIFIED IN ACS-APPROVED PROGRAMS

ACS has approved over 600 chemistry programs to offer an ACS-certified bachelor's degree. Many undergraduate departments offer several degree tracks, and ACS-certified programs have extra requirements and the most demanding curriculum. The certification indicates that the student has completed a degree from a nationally recognized department. The extra preparation associated with an ACS-certified degree is valued by employers and graduate admissions committees.

The student who pursues this rigorous specialization is more likely to enter graduate school: 49.7% of certified 2006 graduates were enrolling in graduate programs in the fall of 2006 compared to 45.1% of non-certified graduates (Appendix Table B–4b). These certified students are also more dedicated to the field of chemistry. Of those bachelor's recipients who pursue full-time graduate studies, 58.0% of certified students choose chemistry programs compared to just 22.0% of non-certified graduates (Appendix Table C–5). This finding is consistent with data from previous years.

Because more certified students than non-certified students enter graduate school, this impacts the representation of certified bachelor's in the workforce. More than two-fifths (40.1%) of non-certified bachelor-level chemists were employed full time, compared to 37.8% who were certified. Certified students were more likely to be in post-doctoral and graduate programs, with 49.8% so engaged, compared to 45.4% students from non-certified programs. About 6% of non-ACS certified students were unemployed, compared to 4.9% of ACS-certified chemists. These numbers are fairly consistent with the 2005 survey.

DEMOGRAPHICS OF NEW GRADUATES

GENDER

The tables in the appendix of this report display many survey results separately for men and women. This report series has documented the increase in the proportion of chemistry degrees awarded to women. In 1994, 41% of chemistry bachelor's and master's and 28% of Ph.D.s were female, according to data from the National Center for Education Statistics. By 2006, the proportion was up to 58% for the undergraduate level, 60% for master's recipients, and 49% for Ph.D.s.

Comparing salaries by gender is important in order to evaluate whether women's salaries compare favorably to men's. As mentioned earlier, tables in Appendix A (A–6 and A–7 for chemistry; Tables A–15 and A–16 for chemical engineering) display these data by employment sector and degree level, which are important determining factors for salary. However, great care should be used in comparing these tables. Ideally, we would also standardize results by other factors shown to have an impact on salary, such as

region of the country and area of specialization. As it is, the numbers in each cell are small so we may not dissect these data further. It appears as though there is little if any difference between men's and women's salaries. In some employment sectors and degree levels, men earn slightly more than women. But just as often, women earn slightly more than men.

CITIZENSHIP

Foreign students comprise a substantial proportion of all science and engineering students in the United States. Graduate programs have come to rely on these students to fill teaching assistantships. Changes in legislation that impact the ability of foreign students to obtain visas can have an effect on chemistry programs. Each year, the ACS reports on the proportion of graduates do not have U.S. citizenship.

Among holders of bachelor's degrees, the proportion of non-U.S. students in chemistry is small. Of all ACS respondents, less than 2% of bachelor's in chemistry were foreign citizens in the U.S. on temporary visas. However, 18.9% of master's and 29.4% of Ph.D.s in chemistry were in the U.S. on temporary visas (Appendix Table F–1). These numbers may be underestimates. After graduating, many foreign students must return to their native countries as their student visas expire. Therefore, we may be less likely to reach non-U.S. graduates.

The representation of native U.S. citizens, naturalized citizens, and permanent residents among chemistry graduates is similar to recent years and varies widely by degree level. At the bachelor's-level, 88.6% were native U.S. citizens, 6.9% were naturalized, and 3.3% were permanent residents. For those with an M.S. in chemistry, the proportions were 67.8% native-born, 9.0% naturalized, and 4.2% permanent residents. Among Ph.D. chemists, just 61.5% were native to the U.S., 4.2% naturalized, and 4.9% permanent residents. These trends are highly consistent with 2005 figures.

Numbers in chemical engineering are similar to those of chemists. As a general rule, however, there is a higher percentage of chemical engineering majors studying in the U.S. under temporary visa status. For instance, among chemical engineering students earning a bachelor's degree, 2.4% were studying under temporary visa status, compared to 1.2% of chemists. Forty-two percent of masters'-level chemical engineering students were studying in the U.S. under temporary visa status, compared with 18.9% of chemistry students. Almost one-third (30.6%) of Ph.D. level chemical engineering students were studying in the U.S. under temporary visa status, compared with 29.4% of chemistry students. These findings appear in Table F–4.

RACE AND ETHNICITY

The racial composition of the chemistry (Table F–3) and chemical engineering (Table F–6) class of 2006 is similar to recent years. Whites represent the majority of all graduates. White graduates comprised 79.3% of chemistry and 73.0% of chemical engineering bachelor's. Among master's-level students, 63.9% of chemists and 56.2% of chemical engineers were white. At the Ph.D. level, 64.3% of chemists and 53.1% of chemical engineers were white.

Asian students constitute a particularly robust percentage of the total student body in chemistry and chemical engineering. Asians represented approximately 10% of bachelor's in both fields, 22.5% of chemistry and 29.9% of chemical engineering master's, and 27.1% of chemistry and 36.8% of chemical engineering doctorates. At the B.S. and Ph.D. level, there are more men than women studying chemical engineering. Equal numbers of men and women study chemical engineering at the master's level. The representation of Asian graduates is generally greater at higher levels of education. This is consistent with the finding that the representation of non-U.S. born graduates increases at higher levels of education. As the number of graduate students from eastern nations increases, the racial composition of graduates changes.

Black students are underrepresented in these fields, particularly at the graduate level. In fact, the number of black Ph.D. graduates who responded to our survey was in the single digits. They comprised 2.4% of Ph.D.s in chemistry and 1.4% of Ph.D.s in chemical engineering. About 3% of chemical engineering master's degree earners in 2006 were black, and about 4.9% of chemistry degree earners were black in 2006. There were more than twice the number of black women as black men graduating with bachelor's degrees in chemistry. Black women graduating with bachelor's degrees in chemical engineering also outnumbered black men.

Scope and Method

OBJECTIVE

The 2006 New Graduate Study, commonly known as the Starting Salary Survey, is the 56th in the series of annual surveys on the employment and future plans of new graduates in chemistry and chemical engineering conducted by the American Chemical Society. A summary of the results of these surveys appear annually in *Chemical & Engineering News (C&EN)*. The 2006 survey appeared in the December 3, 2007 edition of *C&EN* and is included as an appendix in this report.

The primary objective of the survey is to gather data on the starting salaries and occupational status of new chemists and chemical engineers who graduated during the 2005–2006 academic year. The survey covers bachelor's, master's, and doctoral degree recipients. There are two versions of the survey – one for doctoral graduates and another for bachelors and masters graduates. Each questionnaire is about 30 pages long and includes some basic demographic data about the graduate's age, gender, citizenship, and ethnicity. Both versions of the questionnaire appear as appendices to this report.

METHOD OF COLLECTION AND TIMING OF SURVEY

Chemistry departments approved by the American Chemical Society Committee on Professional Training and chemical engineering departments approved by the American Institute of Chemical Engineers and the Accreditation Board for Engineering and Technology (formerly the Engineers' Council for Professional Development) provided names and addresses of students who graduated between July 2005 and June 2006. Questionnaires were mailed to graduates whose names had been provided and had U.S. addresses, totaling 10,348.

EXTENT OF COVERAGE

Survey questionnaires were mailed by first class mail in October 2006. A reminder postcard was mailed later that month. A second mailing was sent in November, followed by a reminder postcard. The methodology generated roughly 2,800 usable responses, resulting in a 27% response rate. About 2,400 responses were from chemists and about 400 were from chemical engineers. Respondents to this survey represented about 16% of all chemistry graduates and roughly 7% of all chemical engineering graduates. This response rate is rather low by comparison to previous surveys. As recently as 1998, the ACS annual salary survey was able to capture nearly 6,000 responses, about 1,100 of which were from chemical engineers. The ACS has been experiencing a gradual decline in response rates for more than a decade.

The median age was 23 for bachelor's-level respondents, 27 for master's-level respondents, and 31 for Ph.D.-level respondents. Women represented 46.7% of the survey respondents, while 53.3% were men.

Technical Notes

DISCREPANCIES AMONG TABLES

Because not all individuals responded to all of the survey items, some pairs of tables contain totals that should be identical but are not. For example, one table may group Ph.D.s by sex and another by employer. The totals will differ unless the number who did not indicate their sex is the same as the number who did not indicate their employer.

ESTIMATES OF MEDIAN SALARIES

Median salaries displayed within the cells of the salary tables are sample medians and are therefore subject to sampling error. This error could be quite large, especially when the number of respondents in the corresponding cell is small. Therefore, median salaries in cells with fewer than 15 respondents should not be used to estimate their corresponding population medians.

DEFINITIONS

The term "inexperienced" as used in the tables refers to those who have 12 months or less of prior professional work experience. The term "chemist" refers to one who received a degree in chemistry. Salary tables are based upon full-time employment. Postdoctoral salaries are analyzed separately. Salaries are reported in U.S. dollars.

"Certified" bachelor's degree-holders are those bachelor's certified by their department or program to ACS. A bachelor's level chemist with a certified degree has completed an ACS-approved curriculum.

For this study, race and ethnicity categories are combined to become mutually exclusive. Hispanics may include all race categories, but racial categories do not include Hispanics.

GEOGRAPHIC REGIONS

Pacific
- Alaska
- California
- Hawaii
- Oregon
- Washington

Mountain
- Arizona
- Colorado
- Idaho
- Montana
- Nevada
- New Mexico
- Utah
- Wyoming

West North Central
- Iowa
- Kansas
- Minnesota
- Missouri
- Nebraska
- North Dakota
- South Dakota

West South Central
- Arkansas
- Louisiana
- Oklahoma
- Texas

East North Central
- Illinois
- Indiana
- Michigan
- Ohio
- Wisconsin

East South Central
- Alabama
- Kentucky
- Mississippi
- Tennessee

Middle Atlantic
- New Jersey
- New York
- Pennsylvania

South Atlantic
- Delaware
- District of Columbia
- Florida
- Georgia
- Maryland
- North Carolina
- South Carolina
- Virginia
- West Virginia

New England
- Connecticut
- Maine
- Massachusetts
- New Hampshire
- Rhode Island
- Vermont

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