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Starting Salaries of Chemists and Chemical Engineers: 2008

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

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American Chemical Society

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Available from the ACS Office of Member Research

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 2008 study.

The survey was conducted by Jeffrey R. Allum, Ed.D., Research Manager, and Gareth Edwards, Research Associate. Gareth Edwards deserves special recognition for his outstanding work in preparing the data for analysis and compiling the extensive set of appendices. Michelle Peters, Ed.D. cleaned, edited, and analyzed the data. She also wrote this report. Eric Stewart served as the copyeditor, helping to ensure that this report is of the highest quality.

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

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Summary of Findings

The *Starting Salaries of Chemists and Chemical Engineers: 2008* 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 2008 resembles graduates of the past couple of years in many respects, indicating that the workforce is somewhat stable. This is good news after a slight downturn in salaries in the early part of the decade. These data do not, however, offer a complete reflection of salaries and employment of new graduates who were affected by the recent economic downturn.

- Salaries for recent master's and Ph.D. graduates in chemistry and bachelor's and Ph.D.s in chemical engineering are rising somewhat faster than inflation. Between 2007 and 2008, the average starting salary for chemistry bachelor's recipients decreased by 2.0%, while chemical engineering B.S. graduates reported a 7.8% increase. However, chemistry and chemical engineering Ph.D.s experienced increases of 3.1% and 5.9%, respectively.
- Postdoctorates in chemistry and chemical engineering reported annual median salaries of $37,000 and $39,000 respectively. The primary factor determining the median salary of postdoctorates was the employment sector within which the individual works. Chemistry postdocs in private industry reported earning $39,000, while those in academia earned $36,000.
- The disparity between men and women at the higher levels of chemistry may be narrowing. In 2008, 45.6% of female bachelor's recipients were enrolled in graduate programs compared to 50.1% of male graduates. However, among master's, 38.4% of men were continuing their education compared to 35.6% of females.
- Approximately half of all chemistry bachelor's were pursuing higher education in the fall of 2008. Of these students, 42.9% were enrolled full-time and 37.4% remained in the field of chemistry. Of chemical engineering bachelor's recipients, 23.2% were enrolled in graduate school full-time and 58.6% chose to continue studying chemical engineering. Among chemical engineers with B.S. degrees, 61.4% were working in full-time permanent positions compared to 27.2% of individuals with B.S. degrees in chemistry.

Salaries for the Class of 2008: Means and Medians

The class of 2008 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, field of work, and employer size.

In 2008, starting salaries were higher for recent recipients of master's and Ph.D. degrees in chemistry with less than a year of work experience. The mean starting salary was $50,916 at the master's level and $70,460 at the doctorate level (increases of 0.7% and 3.1%, respectively, or 0.6% and 3.0% when adjusted for inflation). Meanwhile, the average salary for inexperienced bachelor's recipients was $37,163, or 2.0% lower than the average starting salary in 2007 (2.1% lower when adjusted for inflation).

The job market was strong in the late 1990s to 2000, and salaries for scientists and engineers rose quickly during this period. During the current decade, however, results have been mixed. For example, from 2002 to 2004, salaries in chemistry stagnated, even declining in terms of real dollars; after 2006, they began to increase. From 2006 to 2008, salaries for B.S. and M.S. chemists have shown modest gains when compared to trends in the previous decade.

TABLE 1: 2008 MEAN SALARIES FOR INEXPERIENCED CHEMISTRY GRADUATES (Mean Salary in Dollars)

	Mean Salary 2007	Mean Salary 2008	%Change Current	%Change Constant
BACHELOR'S	37,923	37,163	-2.00	-2.10
MASTER'S	50,554	50,916	0.72	0.62
DOCTORATE	68,339	70,460	3.10	3.00

Note: CPI 12/07-12/08 = 0.1%

Similar to chemistry graduates, chemical engineers had experienced a decline in the real dollar value of starting salaries for novices from 2000 to 2004. From 2007 to 2008, chemical engineering bachelor's and Ph.D. graduates saw modest increases in starting salaries. Inexperienced bachelor's recipients in this field earned a mean salary of $63,232 in 2008, almost $4,600 higher than 2007 for an increase of 7.7% when adjusted for inflation. Data from doctorates in 2008 showed a mean starting salary of $86,130, or 5.8% higher than 2007 after adjusting for inflation.

TABLE 2: 2008 MEAN SALARIES FOR INEXPERIENCED CHEMICAL ENGINEERS (Mean Salary in Dollars)

	Mean Salary 2007	Mean Salary 2008	%Change Current	%Change Constant
BACHELOR'S	58,671	63,232	7.77	7.67
MASTER'S	66,238	61,149	-7.68	-7.78
DOCTORATE	81,325	86,130	5.91	5.81

Note: CPI 12/07-12/08 = 0.1%

Graduates with master's degrees in chemical engineering, on the other hand, reported a decrease in salary compared to the previous year; the mean salary for those with less than a year's work experience was $61,149; down from $66,238 in 2007, for a decrease of 5.8% after inflation.

Mean salaries represent the calculated average starting salary. Because the mean can be greatly influenced by a handful of very high or very low values, it is often helpful to also 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.

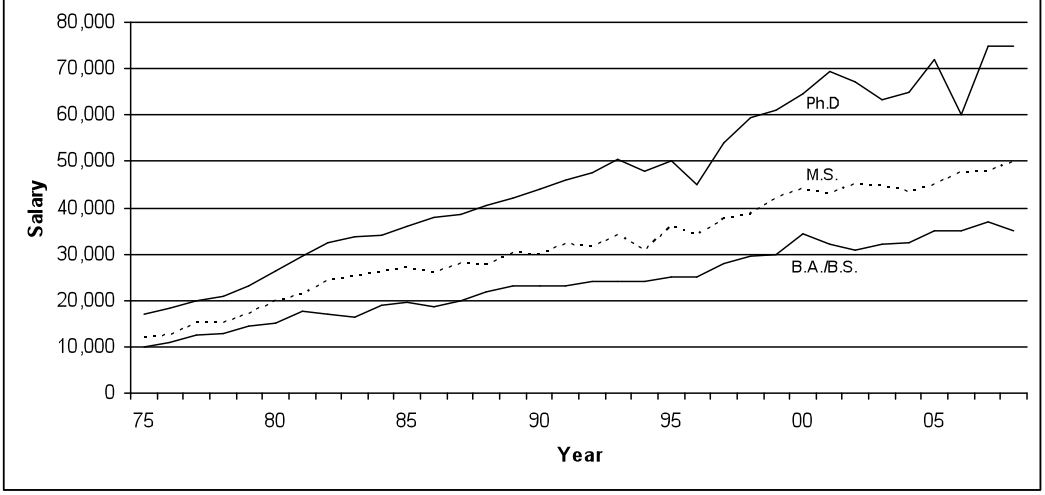
Table 3 displays the median full-time salaries for new graduates by degree level, degree field, and amount of experience. One would expect as degree level and job experience increases, that salary would also increase. This proved to be the case for chemistry bachelor's and master's recipients. Bachelor's in chemistry who were at their job for less than a year had a median salary of $35,000, whereas those with one to three years of experience reported a median salary of $36,911, and those with the most experience reported salaries around $44,000. Master's in chemistry who were at their job for less than a year had a median salary of $49,750, compared to those with one to three years of experience, who reported a median salary of $52,000, while those with the most experience reported salaries around $54,950.

TABLE 3: 2008 MEDIAN SALARIES FOR ALL NEW GRADUATES EMPLOYED FULL-TIME BY EXPERIENCE (Median Salary in Dollars)

	B.A./B.S. Chemistry	M.S. Chemistry	Ph.D. Chemistry	B.A. Chemical Engineering	M.S. Chemical Engineering	Ph.D. Chemical Engineering
Less than 12 months	35,000	49,750	75,000	63,000	60,000	85,000
12-36 months	36,911	52,000	75,000	63,000	62,500	86,550
More than 36 months	44,000	54,950	75,000	67,500	74,000	84,500

Chemical engineering bachelor's and master's recipients reported a somewhat similar increase in salary as length of time on the job increased. Although the mean salaries for bachelor's in chemical engineering were the same for those with less than a year's experience as for those with one to three years of experience ($63,000), they did climb for those with more than three years of experience ($67,500). Master's recipients new to their jobs had a median salary of $60,000, whereas those with the most experience had salaries around $74,000.

Figure 1. Median Starting Salaries for Inexperienced Chemists Working Full-Time, 1975-2008 (in current dollars)



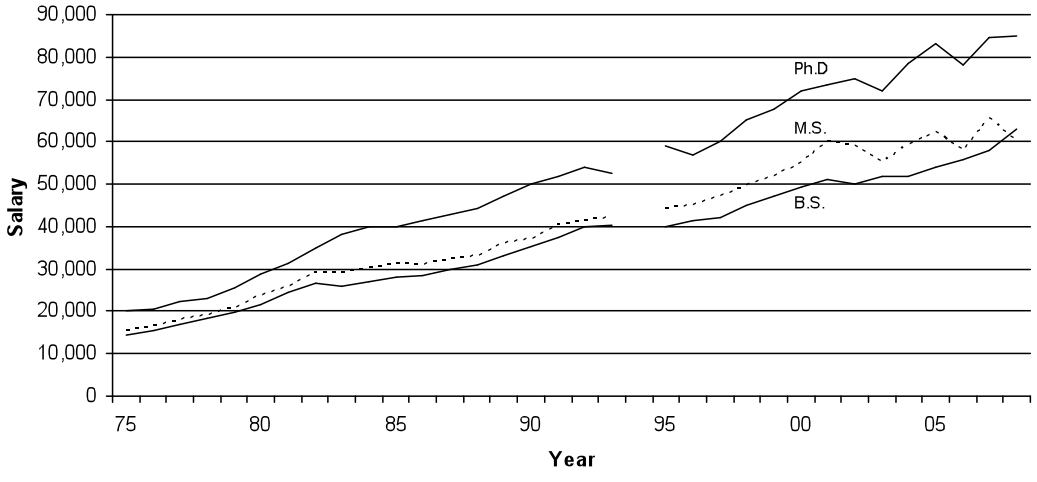
Doctorates in chemistry reported earning the same amount regardless of their amount of time on the job ($75,000), while the salaries of doctorates in chemical engineering

seemed to decrease as length of time on the job increased. Chemical engineering Ph.D.s new to their jobs had a median salary of $85,000, whereas the most experienced Ph.D.s had salaries around $84,500.

There are likely a variety of unique factors involved in determining salaries for Ph.D.s, which may not apply at other levels of education. It may be that those Ph.D.s with more experience are disproportionately employed in an area of the country with a lower cost of living or in an industry with lower pay. There are several other alternate explanations for this anomaly: those with work experience were not leaving the jobs they held while finishing their Ph.D.s; those who were not working while in school may have used their new degree as a bargaining tool during salary negotiation; or those who remained at the same job after completing their doctorates may not be receiving advances or salary increases as a reward for reaching this milestone. This trend should be monitored over the next few years as salaries for the chemistry workforce continue to stabilize.

Because the ACS starting salary survey focuses mainly on collecting data from chemistry graduates, the chemical engineering statistics are based on fewer responses. As such, they should be interpreted with caution. However, the numbers for chemical engineers show great reliability when compared to data from past years. In general, it is clear that the median salaries for those earning degrees in chemical engineering are higher than the salaries of those majoring in chemistry. Bachelor's in chemistry typically earned between $35,000 for less than one year of experience and $44,000 for more than three years of experience. Chemical engineering bachelor's salaries were significantly higher, and ranged between $63,000 for beginners up to $67,500 for the most experienced.

Figure 2. Median Starting Salaries for Inexperienced Chemical Engineers Working Full-Time, 1975-2008 (in current dollars)



Salaries in the two fields become more similar as education level increases. Typical salaries for those chemistry master's just out of graduate school were $49,750, while graduates with an M.S. in chemical engineering earned $60,000 (or 20.6% more than their chemistry M.S. counterparts). Doctorates in chemical engineering reported salaries 13.3% higher than chemistry Ph.D.s; the typical salaries for doctorates in chemistry were $75,000, compared to $85,000 for chemical engineers.

The graphs on this and the preceding page show the median starting salaries by level of degree for chemists (see Figure 1) and chemical engineers (see Figure 2) since 1975. Table 4 displays the same data as Figure 1 and 2, but in a single table. After remaining essentially level in the earlier part of this decade, starting salaries for chemistry graduates for all degree levels have fluctuated and, for the most part, have continued to rise. From 2006 to 2007, salaries for master's recipients rose at a slightly steeper rate than those of bachelor's recipients, while those of Ph.D.s rose even more steeply. From 2007 to 2008, chemistry master's median starting salaries continued to increase (by 3.6%), while bachelor's recipients experienced a decrease of 5.4% and Ph.D. graduates' salaries remained unchanged.

Similarly, starting salaries for chemical engineers present a mixed picture. From 2006 to 2007, median salaries rose for all degree levels (by 3.9% for bachelor's, 12.9% for master's, and 8.3% for Ph.D.s). From 2007 to 2008, in contrast, master's salaries experienced a decrease of 8.4%, while bachelor's (8.5%) and Ph.D.s' (0.6%) salaries experienced increases.

TABLE 4. MEDIAN STARTING SALARIES FOR INEXPERIENCED GRADUATES 1975-2008 (By Degree and in 1000s of Current Dollars)

	Chemists			Chemical Engineers		
Year	B.A./B.S.	M.S.	Ph.D.	B.S.	M.S.	Ph.D.
1975	10	12	17	14.4	15.6	20
76	10.8	12.4	18.3	15.4	16.6	20.7
77	12.6	15.2	20	16.8	18	22.5
78	12.7	15	21	18.2	19.2	23.1
79	14.5	17	23	19.8	21	25.4
1980	15	20	26.4	21.6	23.9	28.8
81	17.7	21.3	29.5	24.5	26	31.5
82	17	24.1	32.4	26.7	29	35
83	16.5	24.9	33.6	26.1	29.3	38
84	18.8	26	34.2	27	30.3	40
1985	19.5	27	35.9	28	31.4	40
86	18.6	26.1	38	28.4	31	41.5
87	20	28	38.4	30	32.5	43
88	21.9	27.7	40.5	31	33	44.4
89	23	30.3	42	33	36	47
1990	23	30	44	35.2	37.2	50
91	23	32	46	37.5	40.2	52
92	24	31.5	47.5	40	41.5	54
93	24	34	50.4	40.5	42.2	52.7
94	24	30.8	48	na	na	na
1995	25	36	50	40	44.2	59.2
96	25	34.1	45	41.5	45	57
97	28	37.5	54	42	47	60
98	29.5	38.5	59.3	45	49.8	65
99	30	42	61	47	52	67.7
2000	34.3	44.1	64.5	49.4	55	72
1	32.2	43	69.5	51	60	73.5
2	31	45	67	50	59	75
3	32	44.5	63.3	52	55	72
4	32.6	43.3	65	52	59.3	78.6
2005	35	45	72	54	62.2	83
6	35	47.4	60	55.8	58	78
7	37	48	75	58	65.5	84.5
8	35	49.8	75	63	60	85

Another way to look at the salary data is to compare median salaries for different degree levels in the current year. In chemistry, those with master's degrees earned 42.1% more than those with bachelor's degrees ($49,750 compared to $35,000). Similarly, Ph.D.s earned about 50.8% more than those with master's degrees ($75,000 compared to $49,750). Among chemical engineering graduates, those with a B.S. degree earned 5.0% more than those with an M.S., while those with doctorates out-earned their colleagues with master's degrees by as much as 41.7% ($85,000 compared to $60,000).

Tables 5 and 6 show summary statistics for starting salaries of chemistry and chemical engineering graduates from 2007 to 2008. This display allows for a direct comparison of the distribution of salaries by degree level between the last two years. Note that for the most part, the mean is fairly 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 for 2007 and 2008 chemistry graduates

grouped in percentiles per degree level. By displaying the 10th and 90th percentiles, we get a better idea of the complete range of salary offers accepted. Among chemistry bachelor's, 80.0% of full-time starting salaries fell between $26,400 and $50,000. Most master's recipient salaries ranged between $33,900 and $70,127, while the corresponding majority of Ph.D.s' salaries ranged from $44,200 to $99,480. As degree level increases, salary increases, as does the range in salary. It is important to note that the salary range between the 90th and 10th percentiles is $23,600 for bachelor's, $36,227 for master's, and $55,280 for Ph.D.s.

The full range of chemical engineering starting salaries for 2007 and 2008 is shown in Table 6. The average salary for recent chemical engineering B.S. graduates was $63,232, and 80.0% of salaries fell between $52,000 and $78,600. Master's recipients averaged $61,149, and most salaries were between $19,600 and $88,400. Chemical engineering Ph.D. salaries generally ranged between $70,000 and $102,000, with an average salary of $85,715. Chemical engineers' salaries were greater, for the most part, than those of chemists, as were their salary ranges. The salary range between the 90th and 10th percentiles was $26,600 for bachelor's, $68,800 for master's, and $32,000 for Ph.D.s.

Salary Factors

The data displayed in Tables 5 and 6 show that even if we hold experience and level of degree constant, there is a wide range of salaries reported by recent graduates just beginning their careers. While some ranges are smaller in proportion to others, we must still reconcile salaries differing by $23,000 to $56,000 for graduates within the same field and degree level.

The large range could 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 example, those employed in private industries typically earned more than those working in academia (see Tables A-5 and A-13). The median salary for chemistry Ph.D.s working for private companies in manufacturing was $79,000 and was $62,000 for non-manufacturing private employers. By comparison, the median Ph.D. salary in universities was only $47,450.

TABLE 5. RANGES OF STARTING SALARIES OF INEXPERIENCED FULL-TIME EMPLOYED CHEMISTRY GRADUATES BY DEGREE: 2007 AND 2008 (in $s)

	Bachelor's		Master's		Doctorate	
	2007	2008	2007	2008	2007	2008
90th Percentile	50,972	50,000	67,000	70,127	87,100	99,480
75th Percentile	42,000	42,000	60,000	62,000	83,000	87,000
50th Percentile	36,700	35,000	47,000	49,750	74,250	75,000
25th Percentile	30,000	30,000	40,000	40,000	56,750	50,000
10th Percentile	27,300	26,400	36,000	33,900	41,450	44,200
Mean	37,923	37,163	50,554	50,916	68,339	70,787
Count	358	349	39	38	76	71
Standard Deviation	11,236	10,660	14,773	12,992	17,938	20,398

The type of work the employer does (or what it produces) also has a bearing on salary (see Tables A-8 and A-16). For example, the median salary for recent chemistry bachelor's recipients employed in pharmaceuticals was $36,000 compared to the overall median of $35,000. Similarly, master's reported $68,000 in this field (versus $55,000 overall) and Ph.D.s earned a median of $80,800 compared to $78,000 across all types of employers.

Number of employees (see Tables A-9 and A-17) and geographic region (see Tables A-11 and A-19) are also relevant to earnings. Small businesses with fewer than 50 employees had lower median salaries than corporations and universities with a larger workforce. The median salary for chemistry bachelor's recipients was $34,000 when there were 50 employees or fewer. For employers with a workforce of 25,000 or more, the median was $43,680. Also, those in the Pacific states and New England typically earned more than those in the central plains states.

Employee characteristics contributing to starting salary may include primary job duties (see Tables A-10 and A-18) and degree specialization (see Table A-12). Those teaching ($48,250) typically earn less than those engaged in either research ($61,000) or development and design ($68,000). Graduates specializing in organic chemistry averaged salaries higher ($37,000 for B.S., $61,000 for M.S.) than those in other fields over all ($35,000 for B.S., $49,750 for M.S.).

Another important comparison in salary differences is that between men and women. Because degree level and type of employer are determining factors of starting salary, Tables A-14 and A-15 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. 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 differences emerge.

In sum, a variety of factors determine the starting salary of chemistry and chemical engineering graduates. When there is a shift of graduates into a different employment sector, type of employer, or region of the country, this in turn impacts the overall average salary. For example, this year only 22.0% of chemistry Ph.D.s were employed in private industry. That proportion was 41.0% in 2007, 49.0% in 2006, and 70.0% in 2005. These salary factors

TABLE 6. RANGES OF STARTING SALARIES OF INEXPERIENCED FULL-TIME EMPLOYED CHEMICAL ENGINEERING GRADUATES BY DEGREE: 2007 AND 2008 (in $s)

	Bachelor's		Master's		Doctorate	
	2007	2008	2007	2008	2007	2008
90th Percentile	71,261	78,600	92,200	88,400	101,000	102,000
75th Percentile	64,000	70,000	71,250	78,000	90,000	95,173
50th Percentile	58,200	63,000	65,529	60,000	84,000	85,000
25th Percentile	52,000	57,000	56,700	51,137	72,500	80,000
10th Percentile	48,100	52,000	51,800	19,600	65,700	70,000
Mean	58,671	63,232	66,238	61,149	81,325	85,715
Count	141	143	12	11	43	34
Standard Deviation	9,795	11,254	12,880	21,282	17,710	15,270

should be considered for their impact on individual earnings and expectations, as well as their effect on the average of all graduates.

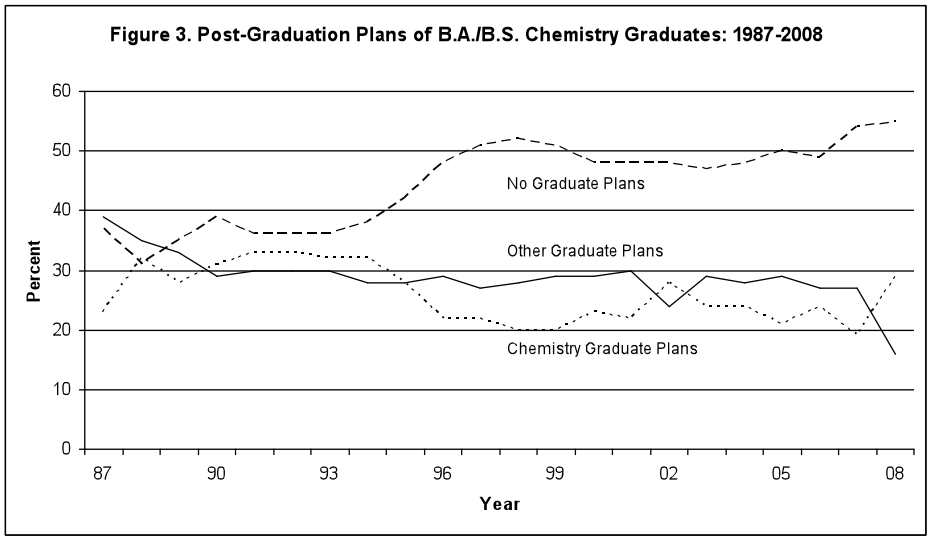
Graduate and Postdoctoral Stipends

As reported last year, graduate and postdoctoral stipends remain relatively stagnant. Across all degree levels and fields of study, no median stipend increased by more than $2,000 over last year's reported stipends, and some remained unchanged (See Table A-20). For chemists and chemical engineers, bachelor's stipends were $24,000, whereas Ph.D.s in both fields reported median postdoctoral fellowships of $37,000 and $39,000 respectively in colleges and universities. Median stipends increased for chemistry bachelor's and master's recipients, decreased for chemical engineering bachelor's and master's recipients, and remained unchanged for Ph.D. graduates in both fields.

Those working in academia comprised the majority of students receiving graduate support. However, there are chemists receiving graduate stipends who are employed in private industry, particularly recent bachelor's recipients. These stipends were higher than the median salary for those employed in manufacturing ($31,000), but not for non-manufacturing ($22,500). These private stipends tend to be associated with a more traditional work arrangement, whereas those employed by universities are typically filling teaching and research assistantships.

Post-Graduate Plans of Bachelor's Chemistry Graduates

While starting salaries provide a view of how recent chemistry and chemical engineering graduates are doing in academia, government, and industry, 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 45.0% of chemistry bachelor's graduates plan to attend graduate school. As Figure 3 shows, that proportion is down markedly compared to the class of 1987. Twenty-one years ago, more than 60.0% of graduates continued their education immediately following graduation. Most of this drop occurred in the mid- to late-1990s, when the proportion pursuing graduate degrees in chemistry dropped significantly. These bachelor's recipients found employment at a time when the job market was strong. Salaries for recent graduates in chemistry peaked in 2000

and then began to fall. It was at this time that the proportion of bachelor's working toward chemistry graduate degrees increased (from 20.0% in 1999 to 29.0% in 2002). Over the last several years, the trend to pursue postgraduate education has been fairly stable.

TABLE 7. PLANS FOR FURTHER STUDY OF BACHELOR'S OF CHEMISTRY & CHEMICAL ENGINEERING GRADUATES: FALL 2008

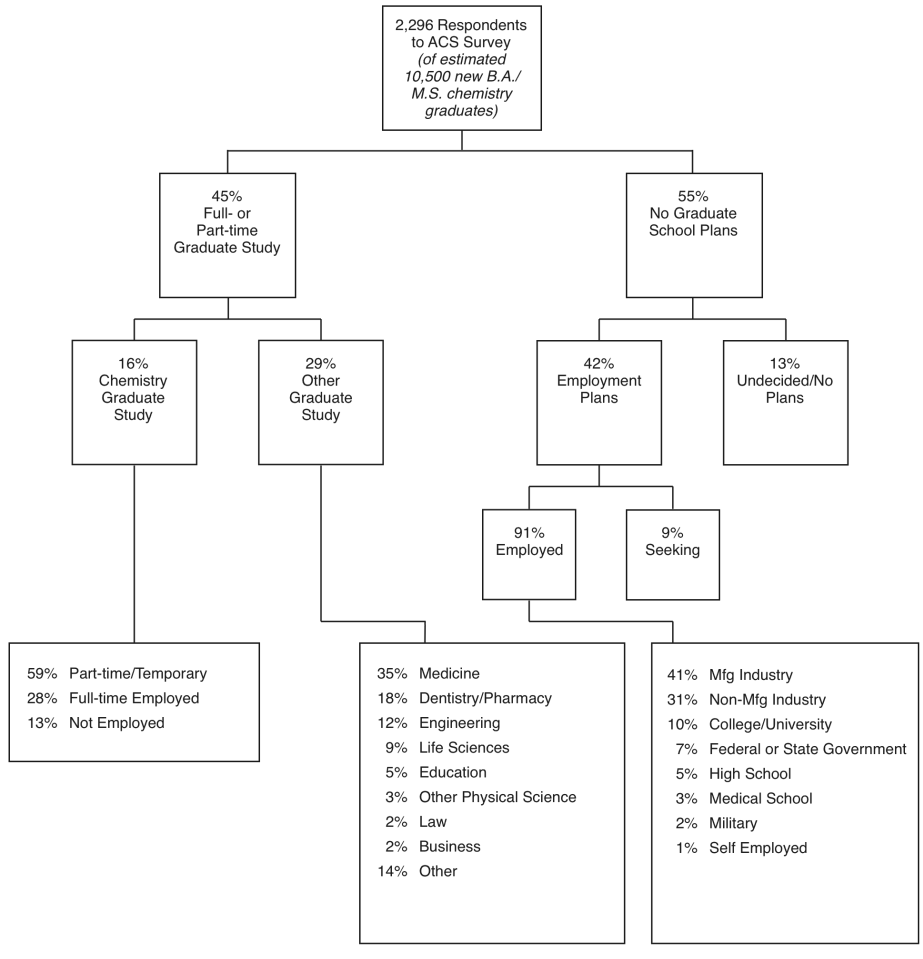
	Chemistry	Chemical Engineering
Total further studies		
Full-time	42.9%	23.2%
Part-time	4.6%	3.6%
No plans for further studies	52.5%	73.2%
Total*	100.0%	100.0%
Number of responses	1900	306

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

A detailed description of the plans of the undergraduate class of 2008 is shown in Figure 4. Slightly more than half of the graduates have no plans to continue school. Most of these individuals (91.0%) were employed as of October 2008. The most common sector of employment was private industry (41.0% manufacturing, 31.0% non-manufacturing), while 10.0% were working at colleges and universities and 7.0% in government positions. Nine percent had not yet found employment at the time of this survey, and 13.0% had not yet made post-graduate plans.

Out of the 45.0% of graduates who did intend to continue their education, 16.0% will do so within the field of chemistry. Most of these students reported working full (28.0%) or part-time (59.0%) to help pay for their education. The remaining graduates (29.0%) will pursue degrees in a discipline other than chemistry. Medicine (35.0%), dentistry and pharmacy (18.0%), and engineering (12.0%) were the most common fields of study.

FIGURE 4. POST-GRADUATION PLANS OF 2008 BACHELOR'S CHEMISTRY GRADUATES



Plans for Advanced Study

More data about chemistry and chemical engineering bachelor's graduate school plans is provided in Table 7. In the fall of 2008, 42.9% of all recent chemistry bachelor's recipients were enrolled in graduate school full-time. An additional 4.6% participated in a part-time program. These numbers are similar to last year's chemistry graduates, indicating a stable trend.

Chemical engineering graduates, on the other hand, were less likely to continue their education. Seventy-three percent of B.S. recipients in this field had no plans for further studies. The draw of competitive salaries in chemical engineering may be pulling these graduates into permanent employment. It is interesting to note that the proportion of chemical engineers attending graduate school full-time in the fall of 2008 (23.2%) is slightly higher than the proportion in 2007 (19.8%). Special attention might need to be paid to these figures in the future.

TABLE 8: FIELDS OF STUDY OF CHEMISTRY AND CHEMICAL ENGINEERING BA/BS GRADUATES: FALL 2008

	Chemistry	Chemical Engineering
FULL-TIME STUDY		
Chemistry and biochemistry	37.4%	4.3%
Chemical or biochemical engineering	1.0%	58.6%
Other engineering	0.8%	14.3%
Physical science	1.5%	1.4%
Life science	2.1%	1.4%
Medicine, dentistry, or pharmacy	37.4%	8.5%
Business or management	1.0%	0.0%
Education	2.5%	0.0%
Law	1.3%	4.3%
All others	15.0%	7.1%
Total*	100.0%	100.0%
Number of responses	842	70
PART-TIME STUDY		
Chemistry or biochemistry	37.4%	18.2%
Chemical or biochemical engineering	3.3%	36.4%
Other engineering	0.0%	18.2%
Physical science	1.1%	0.0%
Life science	5.5%	0.0%
Medicine, dentistry, or pharmacy	18.7%	18.2%
Business or management	3.3%	9.1%
Education	9.9%	0.0%
Law	1.1%	0.0%
All others	19.8%	0.0%
Total*	100.0%	100.0%
Number of responses	91	11

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

Students who decide to continue their education tend to remain within the field of their undergraduate degrees. Thirty-seven percent of B.S. graduates in chemistry are continuing full-time graduate programs in chemistry or biochemistry, and 58.6% of chemical engineers remain in chemical engineering. An undergraduate degree in chemistry also appears to provide an ample background for those who want to enter medical school: 37.4% of these full-time students studied medicine, dentistry, or pharmaceutical science.

Chemical engineering undergraduates were a bit more diverse in their choice of full-time graduate programs. Unlike chemistry graduates, other engineering fields were the second most popular choice (14%) for those pursuing graduate degrees full-time. Interestingly, only 8.5% studied medicine, dentistry, or pharmaceutical science, while a small number chose to enter law school (4.3%).

Part-time graduate students are distinct from full-time students and warrant a separate analysis. These students are typically employed and their goals may be more career-oriented than academic. While the same percentage of chemistry undergraduates pursuing a graduate degree part-time remained in the field as their full-time counterparts (37.4%), a smaller percentage (18.7%) entered medical school, while 5.5% chose to pursue life science studies, and 9.9% studied to become teachers. Chemical engineers resemble chemists in this respect. Of those who are part-time students, 54.6% are studying chemical engineering (36.4%) or some other type of engineering (18.2%), while chemistry (18.2%) and medical school (18.2%) were also popular choices among chemical engineering graduates.

Post-Graduation Employment Status

Table 7 illustrated that slightly less than half of chemistry bachelor's recipients continued their education, while only about a quarter of college graduates in chemical engineering did so. Table 9 presents data on the remaining graduates, and indicates whether they were working or seeking work. This table also displays the employment status of those with advanced degrees. Just over one-quarter (27.2%) of recent bachelor's recipients in chemistry had found permanent full-time employment by October 2008. Ten percent worked temporary full-time jobs and 5.9% had part-time work. Most of the part-time employed chemists were working part-time at a temporary job.

Sixty-one percent of chemistry master's graduates surveyed had no plans to continue their education. Just under half were employed full-time (42.0% permanently and 7.3% in temporary positions), about 6.2% worked part-time, and 33.0% remained enrolled in graduate programs. Forty-two percent of chemistry doctorates found postdoctoral appointments, 44.3% found full-

TABLE 9. POSTGRADUATION STATUS OF CHEMISTRY AND CHEMICAL ENGINEERING GRADUATES: OCTOBER 1, 2008

Major and Employment Status	Bachelor's	Master's	Doctorate
CHEMISTRY			
Full-time employed:			
Permanent	27.2%	42.0%	44.3%
Temporary	10.4%	7.3%	2.9%
Part-time employed:			
Permanent	1.1%	1.0%	0.7%
Temporary	4.8%	5.2%	2.2%
Graduate student, postdoc	43.4%	33.0%	41.8%
Unemployed and seeking employment	9.2%	8.4%	4.4%
Unemployed and not seeking employment	3.9%	3.1%	3.7%
TOTAL*	100.0%	100.0%	100.0%
Number of responses	1882	191	273
CHEMICAL ENGINEERING			
Full-time employed:			
Permanent	61.4%	39.2%	79.0%
Temporary	4.3%	7.8%	1.6%
Part-time employed:			
Permanent	0.3%	5.9%	0.0%
Temporary	2.3%	2.0%	0.0%
Graduate student, postdoc	23.4%	43.0%	16.1%
Unemployed and seeking employment	7.3%	2.0%	1.6%
Unemployed and not seeking employment	1.0%	2.0%	1.6%
TOTAL*	100.0%	100.0%	100.0%
Number of responses	303	51	62

Note: Any deviation from 100 due to rounding.
The unemployment rate calculation only includes respondents in the workforce, which excludes those unemployed and not seeking employment.

time permanent employment, and 2.9% found temporary full-time employment. Only 2.9% worked part-time. These figures were similar to those of the class of 2007.

When compared to chemists, chemical engineers were significantly more likely to find full-time permanent employment. This was true for all except those with master's degrees, among whom the percentage with full-time positions (39.2%) was very similar to the 42.0% of chemistry master's employed full time. At all degree levels, between 39.2% and 79.0% of graduates found full-time permanent work. Along with their higher salaries, this is another indicator of the strong employment opportunities for chemical engineers.

TABLE 10. PARTICIPANT DEMOGRAPHICS BY DEGREE LEVEL, GENDER, AND ETHNICITY (n = 2881)

	Frequency (n)	Percentage (%)
Degree Level		
Bachelor's	2296	79.7
Master's	245	8.5
Doctorate	340	11.8
Gender		
Male	1433	49.7
Female	1420	49.3
Ethnicity		
American Indian	15	0.5
Asian	438	15.8
Black	123	4.4
White	2053	74.0
Other	146	5.3
Age		
20-29	2,462	88.4
30-39	275	9.8
40-49	38	1.4
50-64	10	0.4

One weak point for both chemists and chemical engineers is the unemployment rate. This rate, defined as the proportion of graduates who did not have a job and were seeking work, was approximately 6.6% for the general population and 3.1% for all college graduates during this time period (October 2008[1]). This compares to an unemployment rate that ranged between 8.4% and 9.2% for chemistry bachelor's and master's recipients and was high as 7.3% for chemical engineering bachelor's. Ph.D.s in chemistry experienced an unemployment rate closer to the national average for college graduates (4.4%), while rates for chemical engineering master's (2.0%) and Ph.D.s (1.6%) were actually below the average.

Given that the ACS data are based on a relatively small portion of all graduates and graduates were asked to report on their employment status as of the first week of October 2008, the unemployment figures should be interpreted with caution. The survey was administered several months after graduation, and thus it is possible that many of the unemployed degree recipients eventually found employment.

Demographics of New Graduates

Tables 10 and 11 display the participants' demographics in terms of degree level, gender, ethnicity, and age. As shown in Table 10, the majority of participants were recent bachelor's graduates (79.7%), white (74.0%), and in the 20-29 age bracket (88.4%). Overall, there was an approximately equal distribution of male and female respondents. Table 11 provides a breakdown of gender, ethnicity, and age per degree level. Females (52.8%) outnumbered males (47.2%) among bachelor's recipients, but not for master's and doctorate graduates. As a point of reference, females tend to respond to these surveys at slightly higher rates as well.

[1] As measured by the Bureau of Labor Statistics, 2008 Current Population Survey: http://www.bls.gov.

Graduate 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, 41.0% of chemistry bachelor's and master's and 28.0% of doctorates were female, according to data from the National Center for Education Statistics (NCES). By 2007, the proportion was up to 55.2% at the undergraduate level, 54.1% for master's recipients, and 37.9% of Ph.D.s.

At all levels of education, women represented 49.3% of the respondents in the 2008 ACS survey. However, the representation of women in chemistry decreases as degree level increases. This study found that 52.8% of bachelor's and 43.8% of master's were female. The real difference occurred at the doctorate level, where only 33.4% were female.[2] Compared to last year, the percentage of women among all bachelor's recipients has increased, while it has decreased at the master's and Ph.D. levels.

The disparity between men and women at the higher levels of chemistry may be narrowing. Approximately 45.6% of female bachelor's recipients in 2008 were enrolled in graduate programs compared to 50.1% of male graduates. However, among master's, 38.4% of men were continuing their education compared to 35.6% of females.

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 (see Tables A-6 and A-7 for chemistry and Table A-14 and A-15 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. In some employment sectors and degree levels, men earn slightly more than women. But just as often, women earn slightly more than men.

TABLE 11. PARTICIPANT DEMOGRAPHICS BY GENDER AND ETHNICITY PER DEGREE LEVEL

	Bachelor's (n = 2296)	Master's (n = 245)	Doctorate (n = 340)
Gender			
Male	47.2	56.2	66.6
Female	52.8	43.8	33.4
Ethnicity			
American Indian	0.6	0.4	0.0
Asian	12.8	22.5	30.3
Black	4.5	3.8	4.5
White	76.6	66.3	62.3
Other	5.4	7.1	3.0
Age			
20-29	95.2	76.9	51.6
30-39	3.8	19.4	43.2
40-49	0.8	2.5	4.6
50-64	0.2	1.2	0.6

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 and research assistantships. Changes in legislation that impact the ability of

[2] The ACS numbers on the representation of women are somewhat comparable to the NCES data compiled of all college graduates. In 2007, the NCES found that 57.6% of bachelor's, 60.8% of master's, and 49.9% of Ph.D.s were female. Data from 2008 are not yet available. These numbers were retrieved from the WebCASPAR online database: http://webcaspar.nsf.gov.

foreign students to obtain visas can have an effect on chemistry programs. Each year, the ACS reports on the proportion of graduates that do not have U.S. citizenship.

Among bachelor's, the proportion of non-U.S. students in chemistry is small. Of all ACS respondents, only 1.4% of bachelor's in chemistry were foreign citizens in the U.S. on temporary visas. However, 16.8% of master's and 29.6% of Ph.D.s in chemistry were in the U.S. on temporary visas (see Table F-2). Please note that these numbers may be underestimates; after graduating, many foreign students must return to their native countries as their student visas expire and thus, we may be less likely to reach non-U.S. graduates.[3]

The representation of native U.S. citizens, naturalized citizens, and permanent residents among bachelor's chemistry graduates was similar to recent years and varied by degree level. At the bachelor's level, 86.6% were native U.S. citizens, 8.2% naturalized, and 3.8% permanent residents. For those with an M.S., the proportions were 73.2% native-born, 4.2% naturalized, and 5.8% permanent resident. Among Ph.D. chemists, 63.9% were native to the U.S., 2.6% naturalized, and 4.0% permanent residents.

Numbers in chemical engineering are quite similar to those of chemists (see Table F-5). For chemical engineering bachelor's, 88.2% were U.S. native, 6.3% were naturalized, 4.6% permanent residents, and only 1.0% were in the U.S. on a temporary visa. Among master's, the representation was 47.1% U.S. native, 5.9% naturalized, 9.8% permanent residents, and 37.3% temporary visa. At the doctorate level, 54.8% of recipients were native-born U.S. citizens, 1.6% were naturalized citizens, 8.1% were permanent U.S. residents, and 35.5% had temporary visas.

Race and Ethnicity

The racial composition of the chemistry (see Table F-3) and chemical engineering (see Table F-6) class of 2008 was similar to recent years. Whites represented the majority of all graduates, comprising 73.8% of chemistry and 76.5% of chemical engineering bachelor's. Among master's, 66.0% of chemists and 51.0% of chemical engineers were white, while at the Ph.D. level, 59.7% of chemists and 57.4% of chemical engineers were white.

In 2008, Asians represented approximately 12.5% of chemistry and chemical engineering bachelor's, 17.6% of chemistry and 39.2% of chemical engineering master's, and 28.6% of chemistry and 37.7% of chemical engineering doctorates. The representation of Asian graduates is 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.

[3] According to the NCES data, 4.0% of bachelor's, 33.2% of master's, and 43.8% of Ph.D.s in chemistry held temporary visas in 2007. For chemical engineering graduates in 2007, 8.5% of bachelor's, 43.8% of master's, and 59.2% of Ph.D.s held temporary visas. Data for 2008 are not yet available. http://webcaspar.nsf.gov

At all degree levels, Black students are underrepresented in these fields. In fact, the percentage of Black chemistry graduates who responded to the survey was approximately 5.0% for all degree levels. The percentages were even smaller for chemical engineering graduates (2.6% bachelor's, 0.0% master's, 0.0% Ph.D.). At the undergraduate level, there was a larger proportion of women in this racial category: 5.4% of female chemists and 4.7% of chemical engineers were Black, while Black males only comprised 3.7% of chemists and 1.5% of chemical engineers.

To put these figures in perspective, in the general population of the United States, whites represented 66.0% of the population in 2008.[4] Approximately 12.0% were Black, 4.0% Asian, and 15.0% Hispanic. Native Americans, other races, and those with more than one race represented the remaining 2.0%.

Scope and Method

Purpose

The New Graduate Survey 2008 is the 58th in the series of annual surveys[5] conducted by ACS on the employment and future plans of new chemistry and chemical engineering graduates. The primary purpose of the survey is to gather data on the starting salaries and occupational status of new chemists and chemical engineers who graduated during the 2007-2008 academic year. The survey covers bachelor's, master's, and doctoral degree recipients.

Sampling and Data Collection

The New Graduate Survey 2008 reflects responses solicited from chemistry and chemical engineering college students graduating during the 2007 and 2008 academic year. Chemistry graduates were solicited from universities containing ACS approved chemistry programs, while chemical engineering graduates were solicited from universities with ABET accredited chemical engineering programs.

Volunteers were solicited from a purposeful sample[6] (n = 11,778) of those graduates having full U.S. mailing addresses, to complete either the paper or online version of the New Graduate Survey 2008. The ACS Department of Member Research and Technology (DMRT) identified potential participants for this study by requesting the names and addresses of recent graduates from the Committee on Professional Training (CPT), an internal division of ACS.

Survey questionnaires were mailed by first class mail in late September 2008. A reminder postcard was mailed a week later. A second mailing was

[4] Source: U.S. Census Bureau, 2008 Population Estimates: http://factfinder.census.gov. Note that proportions for whites and Blacks are of non-Hispanics. Hispanics may be of any race.
[5] A summary of the results of these surveys also appears annually in an article published in *Chemical & Engineering News* (C&EN).
[6] This is a purposeful sample because only the chemistry and chemical engineering graduates from ACS or ABET programs having complete U.S. addresses (a selected criteria) were asked to participate in the survey.

sent in early November, followed soon thereafter by a reminder postcard, and a third mailing roughly three weeks later. Of the 11,778 surveys, a total of 2,881 usable responses were received, resulting in a 24.5% response rate. Respondents could complete the survey by mail (55.4%) and via the Web (44.6%).

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 gender and another by employer. The totals will differ unless the number who did not indicate their gender 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.