# Starting Salaries of Chemists and Chemical Engineers 2001

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

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Available from the ACS Office of Society Services

# Contents

# Acknowledgements

Each year, at the direction of its Council Committee on Economic and Professional Affairs, the American Chemical Society (ACS) surveys recent chemistry and chemical engineering graduates to determine trends in starting salaries and employment status. This report presents detailed results of the 2001 new graduate study. A summary of the survey findings were published in the March 18th, 2002 issue of *Chemical & Engineering News*.

Mary Jordan conducted this year's survey and provided the tables for this report. Nadra Garas and Bruce Millar wrote the summary on the following pages. Special thanks go to the 3,599 graduates who took the time to respond to this year's survey.

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# Summary of Findings

THE STARTING SALARIES FOR NEWLY GRADUATED chemists remained relatively strong despite weaker growth in the overall U.S. economy. Starting median salaries for master's and Ph.D. graduates were 7 or 8 percent higher, respectively. However, salaries for bachelor's graduates showed a 1 percent decline. Unemployment for those with bachelor's degrees moved up from 4 percent to 6 percent. The unemployment rate for Ph.D.s remained a reasonably low 3 percent and 5 percent for those with master's degrees. A slightly higher percentage of chemistry graduates went to graduate school or took postdoc positions in 2001 than in 2000.

## Salaries for the Class of 2001: Means and Median

Mean salaries represent the average starting salary and are subject to distortion usually due to some very high individual salaries. They are, however, used in statistical analysis. The median salary is used as the descriptive statistic. The median is the salary representing the midpoint of the salary range for new graduates, where half of the salaries are above the median salary and half of the salaries are below.

Median starting salaries of new graduates are a summary measure. Thus, any trends must be seen as a combination of factors affecting the responding population. Some of these factors are: regional differences in pay structures, characteristics of the new graduates, the type of employer, the size of employer, the work function performed, and the type of industry that hires a large proportion of new graduates. Table 1 presents the 2001 median salaries for new chemistry and chemical engineering graduates based on their degree and level of experience.

**TABLE 1. 2001 MEDIAN SALARIES FOR ALL NEW GRADUATES EMPLOYED FULL-TIME BY EXPERIENCE (MEDIAN SALARY IN CURRENT DOLLARS)**

| | Chemistry | | | Chemical Engineering | | |
|---|---|---|---|---|---|---|
| | B.A./B.S. | M.S. | Ph.D. | B.S. | M.S. | Ph.D. |
| LESS THAN 12 MONTHS | $32,224 | $43,000 | $69,500 | $51,000 | $60,000 | $73,500 |
| 12–36 MONTHS | $36,000 | $49,100 | $63,000 | $53,500 | $60,500 | $82,000 |
| MORE THAN 36 MONTHS | $36,675 | $50,000 | $74,000 | $51,000 | $65,000 | $76,900 |

The median salary of the bachelor's chemistry varied with level of experience. The median salary for the more experienced bachelor's chemistry graduates with more than 36 months of experience was $36,675. The median salary for new bachelor's chemistry graduates with less than 12 months experience was $32,224 at the B.A./B.S. and M.S. level. The median salary for chemical engineering graduates did not vary for two levels of experience; less than 12 months and more than 36 months. The median salary for both these categories was $51,000. The median salary for master's chemical engineering graduates was around $60,000.

**TABLE 2. 2001 MEAN SALARIES FOR INEXPERIENCED CHEMISTRY GRADUATES (MEAN SALARY IN CURRENT & CONSTANT DOLLARS)**

| | Mean Salary 2000 | Mean Salary 2001 | %Change Current | %Change Constant |
|---|---|---|---|---|
| Bachelor's | $34,281 | $33,695 | -1.7 | -3.8 |
| Master's | $43,490 | $43,187 | -0.7 | -2.8 |
| Doctorate | $62,549 | $63,100 | 0.9 | -1.2 |

**TABLE 3. 2001 MEAN SALARIES FOR INEXPERIENCED CHEMICAL ENGINEERING GRADUATES (MEAN SALARY IN CURRENT & CONSTANT DOLLARS)**

| | Mean Salary 2000 | Mean Salary 2001 | %Change Current | %Change Constant |
|---|---|---|---|---|
| Bachelor's | $48,121 | $49,049 | 1.9 | -0.2 |
| Master's | $53,409 | $56,322 | 5.5 | 3.4 |
| Doctorate | $73,115 | $74,387 | 1.7 | -0.4 |

Tables 2 and 3 show the comparison of mean salaries in 2000 and 2001 for inexperienced chemistry and chemical engineering graduates. In 2001, new bachelor's and master's chemistry graduates experienced decreases in overall starting salary levels. The mean salary for new bachelor's chemistry graduates decreased by 1.7 percent in 2001 to $33,695 compared with $34,281 in 2000. The mean salaries for the master's chemistry graduates also showed a loss, while the salaries for Ph.D.s in both disciplines increased. The mean salary for master's chemistry graduate decreased by 0.7 percent, from $43,490 in 2000 to $43,187 in 2001. The mean salary for a new chemical engineering master's graduate increased 5.5 percent, increasing to $56,322 in 2001 from $53,409 in 2000. This gain was the only mean salary to outpace inflation.[1] The mean salary for a new Ph.D. chemist increased from $62,549 in 2000 to $63,100 in 2001, an increase of 0.9 percent. New chemical engineering Ph.D.s experienced an increase of 1.7 percent in the mean salary that climbed to $74,387 in 2001.

[1] The Consumer Price Index rose 2.1 percent from Oct. 2001 to Oct. 2002. It is used as an approximation for inflation.

During the last five years, the median starting salaries for new chemistry graduates have continued to increase. However, in 2001 the median starting salaries for new chemistry bachelor's and master's graduates did not increase. On the other hand, the median salary for new Ph.D. chemistry graduates continued to increase by $5,000 between 2000 and 2001.

**FIGURE 1. MEDIAN STARTING SALARIES FOR INEXPERIENCED CHEMISTS WORKING FULL-TIME (IN CURRENT DOLLARS 1975-2001)**

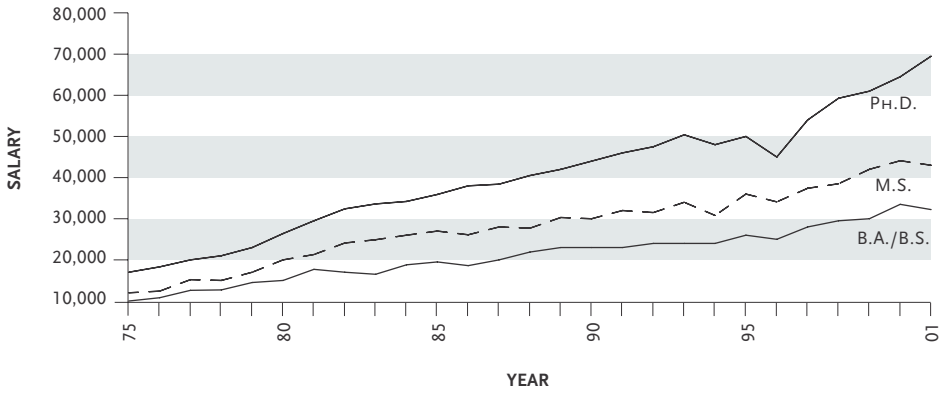



**FIGURE 2. MEDIAN STARTING SALARIES FOR INEXPERIENCED CHEMICAL ENGINEERS WORKING FULL-TIME (IN CURRENT DOLLARS 1975-2001)**

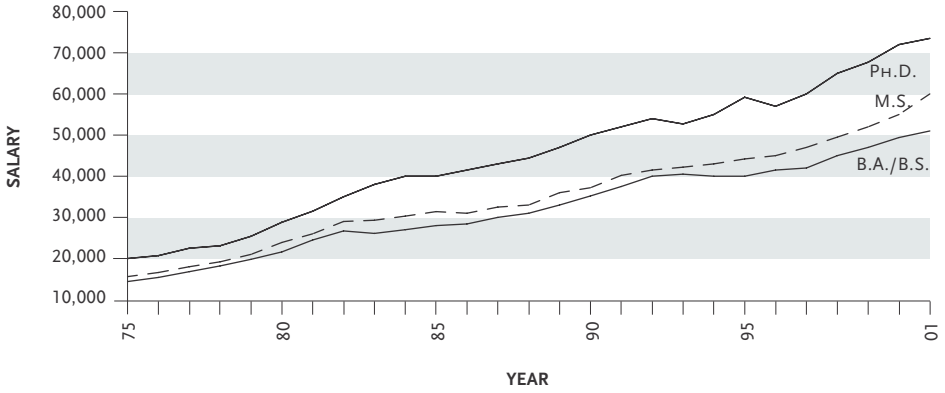


**TABLE 4. MEDIAN STARTING SALARIES FOR INEXPERIENCED GRADUATES 1975-2001 (BY DEGREE AND IN 1000S OF CURRENT DOLLARS)**

| | 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 |

The slight decrease in bachelor's and master's starting median salaries between 2000 and 2001 appears to be more a realignment from 1999 after spectacular increases in 2000. The Class of 2000 showed the highest salary gains and strongest employment figures in a decade. While not as strong, the figures from the Class of 2001 appear more in line with the class of 1999.

Historically, chemical engineering graduates have fared better in starting salaries than chemistry graduates. While chemists' starting salaries languished in the 1980s and till the mid-1990s, chemical engineering graduates consistently gained increases in starting salaries. This continued with the Class of 2001.

The median starting salaries for all new chemical engineering graduates increased in 2001. The median starting salary increased to $51,000 in 2001, compared with $49,400 in 2000. The largest increase was for new master's chemical engineering graduates. Their median starting salary increased to $60,000 in 2001, up from $55,000 in 2000. The median starting salary for new Ph.D. chemical engineering graduates increased from $72,000 in 2000 to $73,500 in 2001. See Table 4 for median starting salaries of inexperienced graduates by degree from 1975 to 2001.

## SALARY FACTORS

The type and characteristics of the employer were a critical factor in determining the salary levels. The manufacturing sector offered the highest salaries for all graduates. The new bachelor's chemistry graduates who worked in the manufacturing sector had the highest median salary ($35,000).

Colleges and universities offered the second highest median salary for new chemistry bachelor's graduates ($33,000). The median salary for inexperienced master's chemists working in manufacturing was $50,000. The highest median salary for chemistry Ph.D.s was $73,500, also in the manufacturing sector. The median salary for Ph.D.s in the non-manufacturing sector was $64,500 and $60,000 for those who work in non-federal government agencies.

As with chemists in general, the growth of employment in industry since the mid-1900's has been dominated by rapid growth in the pharmaceutical industry. The single largest employer of new grads in 2001 was again the pharmaceutical industry. This employer also paid among the highest median starting salaries for its new graduates: $37,000 for inexperienced bachelor's chemists; $53,000 for master's and $73,500 for doctorates. For inexperienced chemical engineers, the median starting salaries were also among the highest at all degree levels: $54,000 for bachelor's, $60,000 for master's and $77,500 for doctorates.

In industry, larger employers generally pay more than smaller ones. In fact, one of the strongest predictors of starting salaries is the size of the company. Bachelor's chemists in larger firms (25,000 or more employees) started at about $10,500 more than those employed in small firms (less than 50 employees.)

New M.S. chemists in industry were apt to be scattered at all sizes of firms. The employer-size factor affected them but to a slightly lesser extent than those with other chemistry degrees. M.S. chemists started at $55,000 at large firms, or $15,500 more than at small firms. Ph.D.s tended to work at larger firms, where their median starting salaries was $75,000, while the median for smaller companies was $65,000.

Examining the median salaries for full-time employment of chemistry and chemical engineering graduates in industry indicates that with only two exceptions (B.A./B.S. chemistry and M.S. Chemical Engineering), the median salary of male graduates was higher than their female colleagues.

For chemical engineers, the higher the degree, the more they were apt to work in larger firms. Very few chemical engineers with master's and doctorate degrees found employment with firms with fewer than 500 employees. Bachelor's chemical engineers were newly employed in firms of all sizes, but the majority was working in larger firms with more than 25,000 employees. As with chemists, the pay differed according to the size of the company. The bachelor's chemical engineers' salaries differed by about $8,300 between the smallest and the largest firms (less than 50 employees and more than 25,000 employees.)

Regional differences in pay tend to be tied to the type and size of employers in the region (for a list of regions see page 17.) Salaries for bachelor's chemists graduates were highest in the Middle Atlantic, New England and Pacific ($33,000 to $35,000) and lowest in the East South Central and West North Central ($25,000 to $28,500.) Median salaries for new B.S. chemical engineers were highest for those employed in East South Central, West South Central, and Middle Atlantic ($53,000 to $53,850). It was lowest in West North Central, South Atlantic and New England ($47,500 to $49,000.)

Proportionally, bachelor's chemical engineers were employed nationwide, with an edge to the Middle Atlantic.

Generally speaking, bachelor's chemists receive higher starting salaries if they received certification from an ACS-approved program. The overall median for inexperienced B.A./B.S. chemists who were certified was $34,000, compared with $31,750 for chemists without certification.

## BACHELOR'S CHEMISTS AND THEIR FIRST JOBS

Median starting salaries for new bachelor's chemistry graduates tend to be very dependent on the type of job he or she has obtained. New chemistry graduates who worked as full-time research scientists had the highest median salary ($35,000). New graduates who work as full-time teachers had the lowest median salary ($29,912). The median salary for new graduates for development and design was $33,500 and the median salary managerial and administrative positions was $30,000.

Tables 5 and 6 show the percentile ranges for chemistry and chemical engineering graduates. As noted earlier, the median is much higher for chemical engineering new graduates. Nonetheless, the standard deviation for new chemists' salaries tends to be greater and in many cases the very top salaries go to new grads in chemistry. The lowest salaries also tend to go to chemistry graduates.

**TABLE 5. RANGES OF STARTING SALARIES OF INEXPERIENCED FULL-TIME EMPLOYED CHEMISTRY GRADUATES BY DEGREE: 2000 AND 2001 (IN CURRENT DOLLARS)**

| | DEGREE LEVEL | | | | | |
|---|---|---|---|---|---|---|
| | Bachelor's | | Master's | | Doctorate | |
| Salaries | 2000 | 2001 | 2000 | 2001 | 2000 | 2001 |
| 90th Percentile | 45,000 | 45,000 | 54,600 | 55,003 | 80,000 | 80,000 |
| 75th Percentile | 39,000 | 39,000 | 50,000 | 53,000 | 74,450 | 75,000 |
| 50th Percentile | 33,500 | 32,224 | 44,100 | 43,000 | 64,500 | 69,500 |
| 25th Percentile | 29,000 | 27,000 | 35,000 | 33,500 | 50,250 | 53,000 |
| 10th Percentile | 25,000 | 24,000 | 26,200 | 30,000 | 37,450 | 37,800 |
| Mean | 34,281 | 33,695 | 43,490 | 43,187 | 62,549 | 63,100 |
| Count | 477 | 481 | 51 | 55 | 48 | 127 |
| Standard Deviation | 8,218 | 9,205 | 12,082 | 10,800 | 16,892 | 16,242 |

**TABLE 6. RANGES OF STARTING SALARIES OF INEXPERIENCED FULL-TIME EMPLOYED CHEMICAL ENGINEERING GRADUATES BY DEGREE: 2000 AND 2001 (IN CURRENT DOLLARS)**

| | DEGREE LEVEL | | | | | |
|---|---|---|---|---|---|---|
| | Bachelor's | | Master's | | Doctorate | |
| Salaries | 2000 | 2001 | 2000 | 2001 | 2000 | 2001 |
| 90th Percentile | 56,000 | 55,600 | 62,800 | 65,530 | 82,000 | 85,680 |
| 75th Percentile | 52,000 | 54,500 | 60,000 | 61,750 | 77,000 | 80,000 |
| 50th Percentile | 49,400 | 51,000 | 54,960 | 60,000 | 72,000 | 73,500 |
| 25th Percentile | 45,000 | 46,000 | 49,250 | 55,250 | 65,000 | 71,000 |
| 10th Percentile | 38,000 | 35,920 | 38,854 | 37,500 | 61,200 | 64,800 |
| Mean | 48,121 | 49,049 | 53,409 | 56,322 | 73,115 | 74,387 |
| Count | 417 | 207 | 33 | 16 | 55 | 35 |
| Standard Deviation | 7,346 | 7,570 | 9,075 | 11,013 | 13,318 | 8,262 |

## PLANS FOR ADVANCED STUDY

A summary of the plans of 2001 graduates appears in Tables 7 and 8. The proportion of new chemistry bachelor's who planned to continue full-time studies in the fall fell slightly in 2001. About 52 percent of new chemistry graduates were planning on pursuing advanced studies in the fall of 2001. The majority of those who planned to enroll in graduate school were intending to study full-time (47 percent) and 5 percent were planning to study part-time in the fall.

The majority of bachelor's in chemical engineering (79 percent) had no plans for any graduate study. In 2001, about 21 percent of new B.S. chemical engineering graduates intended to enter graduate school, or about the same as in 2000. See Table 7 on the plans for further studies of new bachelor's chemists and chemical engineering graduates. Of all chemical engineering graduates, 14 percent planned to study full-time and only 7 percent planned to study part-time in the fall of 2001.

**TABLE 7. PLANS FOR FURTHER STUDY OF BACHELOR'S CHEMISTRY & CHEMICAL ENGINEERING GRADUATES: FALL 2001 PLANS**

| Plans | Chemistry | Chemical Engineering |
|---|---|---|
| Total further studies | 51.8% | 21.3% |
| Full-time | 46.7% | 14.1% |
| Part-time | 5.1% | 7.2% |
| No plans for further studies | 48.1% | 78.7% |
| Total* | 99.9% | 100.0% |
| Number of responses | 2,306 | 478 |

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

B.A./B.S. chemistry and chemical engineering graduates tend to prefer full-time graduate programs. About 43 percent of chemistry graduates who planned to attend graduate programs indicated that they were planning further studies in the fields of chemistry and biochemistry. This was followed by 34 percent of the chemistry graduates enrolling in medicine, dentistry or pharmacy. On the other hand, the majority (57 percent) of the chemical engineering graduates who planned to attend graduate school indicated that they intended to pursue further studies in the field of chemical or biochemical engineering.

Among the chemistry graduates, more female respondents (6 percent) reported that they planned part-time studies during the fall 2001 in biochemistry, while only 3 percent of the male chemistry graduates indicated an interest in that same field. However, both male and female chemistry graduates indicate similar levels of interest in biochemistry as their field of graduate studies when they intended to become enrolled full-time in fall 2001. See Table 8 on the fields of further studies of new bachelor's chemists and chemical engineering graduates.

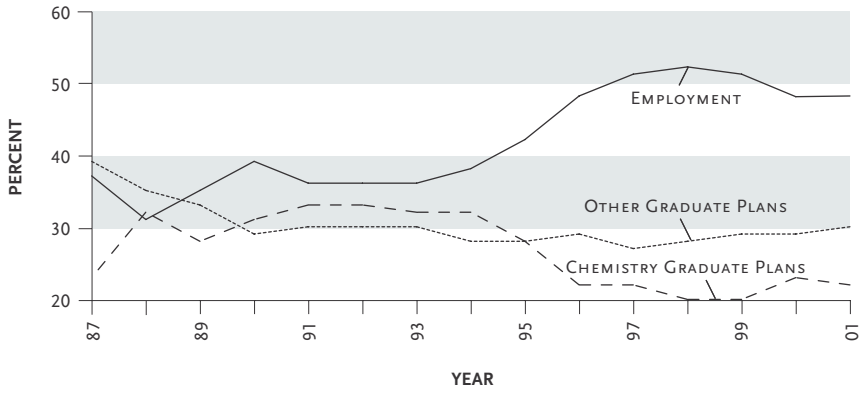
**TABLE 8. FIELDS OF STUDY OF CHEMISTRY AND CHEMICAL ENGINEERING BACHELOR'S GRADUATES: FALL 2001**

| Plans | Chemistry | Chemical Engineering |
|---|---|---|
| FULL-TIME STUDY | | |
| Chemistry and biochemistry | 43.0% | 3.4% |
| Chemical or biochemical engineering | 1.7% | 56.9% |
| Other engineering | 2.0% | 17.2% |
| Physical science | 2.7% | 0.0% |
| Life science | 2.1% | 0.0% |
| Medicine, dentistry, or pharmacy | 34.0% | 10.3% |
| Business or management | 1.5% | 3.4% |
| Education | 3.0% | 1.7% |
| Law | 2.5% | 1.7% |
| All others | 7.5% | 5.2% |
| Total* | 100.0% | 99.9% |
| Number of responses | 1,196 | 58 |
| PART -TIME STUDY | | |
| Chemistry of biochemistry | 43.2% | 3.3% |
| Chemical or biochemical engineering | 3.4% | 43.3% |
| Other engineering | 4.2% | 20.0% |
| Physical science | 6.8% | 0.0% |
| Life science | 2.5% | 0.0% |
| "Medicine, dentistry, or pharmacy" | 14.4% | 3.3% |
| Business or management | 5.9% | 16.7% |
| Education | 7.6% | 3.3% |
| Law | 1.7% | 10.0% |
| All others | 10.2% | 0.0% |
| Total* | 99.9% | 100.0% |
| Number of responses | 118 | 30 |

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

Fields of Study of Bachelor's Chemistry and Chemical Engineering Graduates in Figure 3 shows the trend for post-graduation plans among B.A./B.S. chemistry graduates over the last fifteen years. The data presented compare plans of new graduates to immediately pursue employment opportunities, enroll in chemistry graduate programs or enroll in other graduate programs. The trend for employment plans among new chemistry graduates has been increasing from 1994 to 1999, peaking at 52 percent in 1998. Over the last several years, this trend tended to level out at 47 percent in 2000 and 48 percent in 2001, indicating the almost half of B.A./B.S. chemistry graduates tend to enter the job market after graduation. Since 1995, more new chemistry graduates have tended to plan for advanced studies in other graduate programs. The data presents a trend, which indicates that enrollment in chemistry graduate programs, has been less over the last seven years.

**FIGURE 3. POST GRADUATION PLANS OF BACHELOR'S CHEMISTRY GRADUATES: 1987–2001**




**THE FALL PLANS OF BACHELOR'S CHEMISTS**

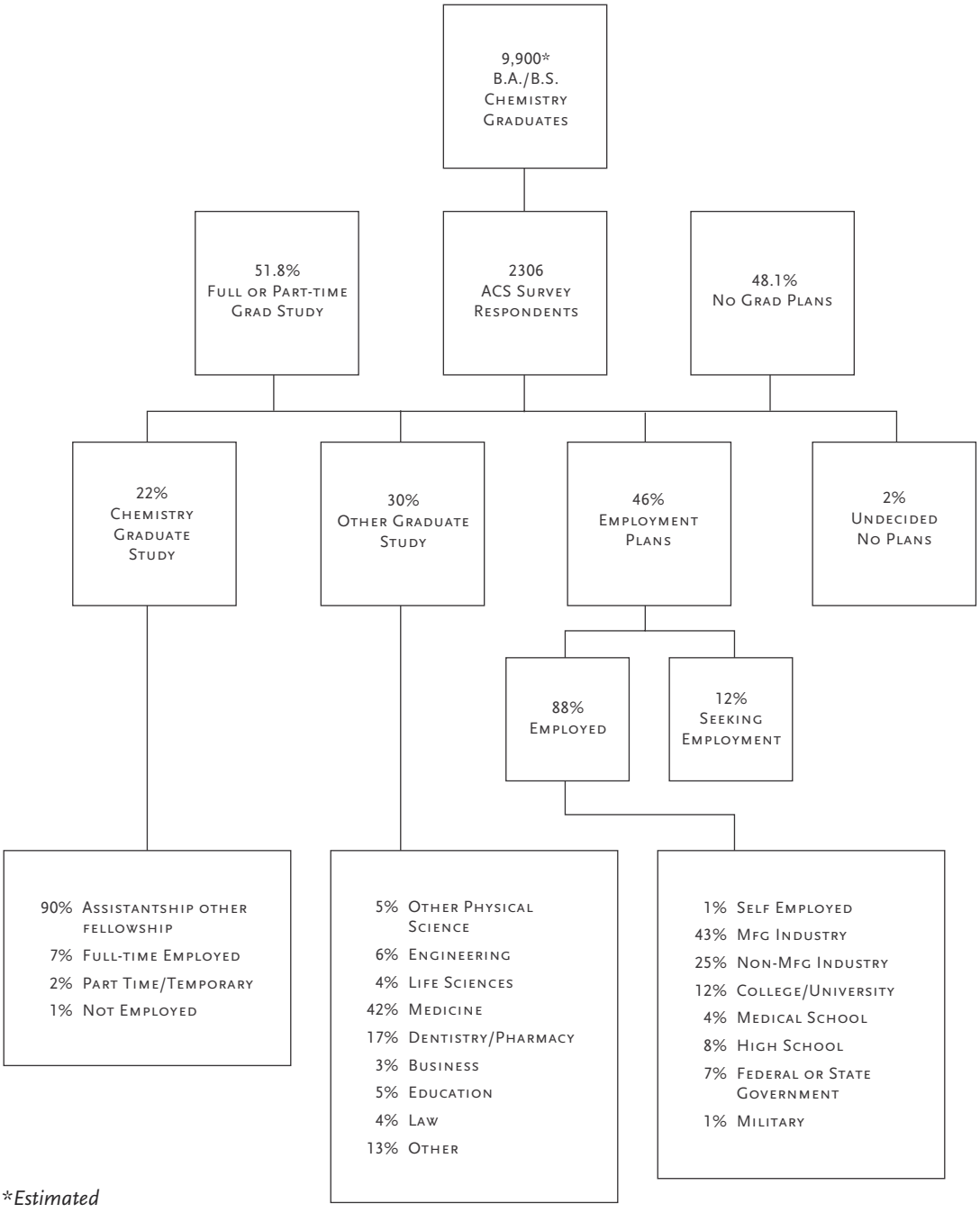
Figure 4 shows the detailed plans of 2001 chemistry bachelor's graduates. The percentage of bachelor's chemists who planned to continue graduate study in chemistry fell from 23 percent in 2000 to 22 percent in 2001.

Of the chemistry graduates who chose immediate employment, 88 percent reported that they were currently employed and 12% reported that they were seeking employment. Of those chemistry graduates who chose immediate employment, the majority chose industrial employment (77 percent). The proportion that chose employment in colleges and universities increased to 12 percent in 2001 as compared to 7 percent in 2000. The proportion of bachelor's chemists who chose to work for the federal or state government also increased to 7 percent in 2001, up from 4 percent in 2000.

**POSTDOCTORAL FELLOWSHIPS**

In 2001, the proportion of Ph.D. chemists who accepted postdoctoral fellowships was much higher than Ph.D. chemical engineers. In 2001, the percentage of Ph.D. chemists who accepted postdoctoral fellowships was 45 percent, compared to 41 percent in 2000. On the other hand, only 19 percent of Ph.D. chemical engineering graduates accepted postdoctoral fellowships, compared to 17 percent in 2000. In 2001, more than twice as many Ph.D. chemistry graduates accepted fellowships compared to Ph.D. chemical engineering graduates. This implies that the employment opportunities that are available to these two groups differ significantly. Full-time employment is a strong option for Ph.D. chemical engineering graduates.

**FIGURE 4. POST GRADUATION PLANS OF 2001 BACHELOR'S CHEMISTRY GRADUATES**




**Estimated*

**GRADUATE AND POSTDOCTORAL STIPENDS**

Bachelor and master's graduates in chemistry who were on graduate assistantships or fellowships at a university typically receive about $18,000, an increase from $17,000 in 2000. Stipends for academic postdoctoral fellowships for Ph.D. chemists were $29,000, compared with $27,000 in 2000. In 2001, Ph.D. chemical engineering graduates received a stipend of $31,000. Stipends for graduates at medical schools tended to be higher across the board for all graduates. In 2001, the medical school stipend for bachelor's and bachelor's chemical engineering graduates was $20,000. The stipend for Ph.D. chemists was $31,101 and $33,000 for Ph.D. chemical engineering.

**POSTGRADUATION EMPLOYMENT STATUS**

While the proportion of new bachelor's chemistry graduates who took full-time temporary employment remained relatively stable (9 percent) over the last two years, only 31 percent of the new chemistry graduates had full-time permanent employment. This compares with 35 percent of new graduates in full-time permanent employment in 2000. On the other hand, the vast majority of new bachelor's chemical engineering graduates (74 percent) had full-time employment and only 14 percent went into graduate programs.

Full-time employment for master's of chemistry and chemical engineering declined in full-time placements for new master's as compared to 2000. In 2001 full-time permanent employment placements for master's chemistry graduates fell to 49 percent, down from and 56 percent in 2000. Full-time permanent employment for master's chemical engineering graduates fell to 56 percent in 2001, down from 68% in 2000. While the full-time temporary placements for master's chemistry graduates remained stable at 6 percent, full-time temporary placements for master's of chemical engineering graduates rose to 5 percent in 2001.

The trend for full-time permanent employment for Ph.D. chemistry graduates remained stable over the last two years. For Ph.D. chemistry graduates, full-time employment remained at 45 percent in 2000 and 2001, an increase from 43 percent in 1999. However, full-time permanent employment for Ph.D. chemical engineering graduates fell to 71 percent in 2001 from 73 percent in 2000. In 2001, the new Ph.D. chemical engineering graduates who reported that they were unemployed and seeking employment increased to 6 percent from 5 percent in 2000. The proportion of new Ph.D. chemistry graduates who were unemployed and seeking employment remained stable in 2000 and 2001 (3 percent). See Table 9 for post graduation employment status for chemistry and chemical engineering graduates.

**TABLE 9. POSTGRADUATION STATUS OF CHEMISTRY AND CHEMICAL ENGINEERING GRADUATES: OCTOBER 11, 2001**

| Major and Employment Status | Bachelor's | Master's | Doctorate |
|---|---|---|---|
| CHEMISTRY | | | |
| Full-time employed: | | | |
| Permanent | 31.3% | 49.3% | 44.8% |
| Temporary | 9.4% | 5.6% | 2.8% |
| Part-Time employed: | | | |
| Permanent | 0.6% | 1.5% | 0.2% |
| Temporary | 2.6% | 3.7% | 1.3% |
| Graduate student, postdoc | 45.8% | 33.2% | 44.6% |
| Unemployed and seeking employment | 6.0% | 5.2% | 2.6% |
| Unemployed and not seeking employment | 3.3% | 1.5% | 3.7% |
| TOTAL* | 100.0% | 100.0% | 100.0% |
| Unemployment as of the week of 10/8/2001 | 6.0% | 5.2% | 2.6% |
| Number of responses | 2,298 | 268 | 460 |
| CHEMICAL ENGINEERING | | | |
| Full-time employed: | | | |
| Permanent | 74.0% | 55.6% | 70.5% |
| Temporary | 3.6% | 4.8% | 1.3% |
| Part-Time employed: | | | |
| Permanent | 0.5% | 0.0% | 0.0% |
| Temporary | 0.7% | 0.0% | 0.0% |
| Graduate student, postdoc | 14.0% | 34.9% | 19.2% |
| Unemployed and seeking employment | 5.1% | 4.8% | 6.4% |
| Unemployed and not seeking employment | 2.2% | 0.0% | 2.6% |
| Total* | 100.0% | 100.0% | 100.0% |
| Unemployment as of the week of 10/8/2001 | 5.5% | 4.8% | 6.4% |
| Number of responses | 415 | 63 | 78 |

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

## EMPLOYMENT STATUS AND CERTIFICATION TO ACS

Certified B.A./B.S. graduates were more likely to be employed in full-time permanent positions than those not certified. On the other hand, certified graduates were more apt to plan further studies than those graduates who are not certified. About 50 percent of the bachelor's chemistry graduates certified from ACS-approved programs intended to pursue full-time graduate studies, while only 45 percent of non-certified graduates were heading into graduate school.

Certified graduates were also less likely than those non-certified to be unemployed or working in temporary or part-time jobs. Among those inexperienced bachelors' employed full-time. The percentages of those unemployed but seeking employment were 6 percent, or identical for certified and non-certified graduates.

## DEMOGRAPHIC COMPOSITION OF NEW GRADUATES

### SEX

The participation of women in the fields of chemistry and biochemistry is increasing at all levels. The proportion of new women graduates of chemistry programs at the bachelor's level was 57 percent, compared to 52 percent in 2000. The same trend is evident for both master's and doctoral degrees. More women (39 percent) graduated from Ph.D. chemistry programs in 2001 than 35 percent in 2000.

The same trend is evident among new graduates of chemical engineering programs. The proportion of chemical engineering degrees awarded to women continues to increase. At the bachelor's level, 45 percent of the new graduates were women in 2001, as compared to 40 percent in 2000. At the master's level, only 37 percent of the degrees were awarded to women in 2001, but this represents an increase of 5 percent since 2000.

At the doctoral level, the proportion of women continues to increase in both fields. In 2001, 39 percent of the chemistry Ph.D.s were awarded to women, while 33 percent were awarded to women in 2000. The largest increase was among the chemical engineering Ph.D.s that were awarded to women. In 2001, 33 percent of the chemical engineering Ph.D.s were awarded to women, compared to only 20 percent in 1999.

### CITIZENSHIP

In 2001, 95 percent of bachelor's chemists and chemical engineers were U.S. citizens. This is a decline of one percentage point from the previous year. The proportion of U.S. native graduates declines for each higher degree, falling to 54 percent for the Ph.D. chemical engineering programs. The highest proportion of U.S. native graduates is from chemistry and chemical engineering programs at the bachelor's level.

The proportion of bachelor's chemistry and chemical engineering graduates who had temporary visas remained at the same level in 2001; one percent for chemistry graduates and two percent for chemical engineering. Unlike the previous two years, among master's chemistry graduates, the proportion of graduates who have temporary visas increased to 22 percent in 2001. During 1999-2000, the master's chemistry graduates fell from 20 percent in 1999 to 16 percent in 2000. The proportion of Ph.D. chemistry graduates rose to 25 percent in 2001, up from 21 percent in 2000. However, this level is still lower than 27 percent of Ph.D. chemistry graduates with temporary visas in 1999.

Among the master's chemical engineering graduates, the proportion of graduates with temporary visas fell to 26 percent in 2001, down from 29 percent in 2000. However, the proportion of doctoral graduates of chemical engineering programs on temporary visas was 35 percent in 2001, an increase from 23 percent in 2000.

**RACE AND ETHNICITY**

The number of Asian graduates tends to increase as a proportion of total graduates for the higher degrees. In 2001, Asians were 12 percent of the bachelor's chemists and chemical engineers. However, the proportion of Asian graduates increases to 22 percent among the master's chemistry degree and to 26 percent for the master's of chemical engineering. The same proportion of Asian graduates of Ph.D. programs in maintained, 22 percent of all Ph.D. chemistry degrees awarded and 27 percent of all Ph.D. chemical engineering degrees awarded. On the other hand, the opposite trend is observed among the African American population of chemists and chemical engineers. About 6 percent of bachelor's of chemistry degree are awarded to African Americans and 3 percent of the bachelor's of chemical engineering degrees. While the proportion of African American graduates of master's programs increases to 6 percent in chemistry and 5 percent for chemical engineering, it declines for the doctoral programs. Only 2 percent of the Ph.D. chemistry degrees and 3 percent of the Ph.D. chemical engineering degrees were awarded to African Americans. The same trend is evident among Hispanic population of chemists and chemical engineers. The proportion of bachelor's chemists is 3 percent in 2001 and only one percent for Ph.D.s in chemical engineering.

# Scope and Method

**OBJECTIVES**

The 2001 New Graduate Study (Starting Salary Survey) is the 51st 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. Summaries of the results of these surveys appear annually in *Chemical & Engineering News*. The delay in notification of departments of chemical engineering for graduate lists resulted in less than half the normal number of graduates' names and directions becoming available by the time of the survey in October, 2001.

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 2000-2001 academic year. The survey covers bachelor's, master's, and doctoral degree recipients. In addition, since 1973, the survey provides information on graduates' sex, citizenship, and ethnicity.

**METHOD OF COLLECTION AND TIMING OF SURVEY**

Chemistry departments approved by ACS and chemical engineering departments approved by the American Institute of Chemical Engineers and the Engineer's Council for Professional Development provided names and addresses of students who graduated between July, 2000 and June, 2001. The survey was mailed out from October through December, 2001. Questionnaires were mailed to those graduates whose names had been provided and who had U.S. addresses.

**EXTENT OF COVERAGE**

The survey for the Class of 2001 was also available in a Web version at http://chemistry.org/careers.html. A postcard was send to 10,713 graduates during the third week of October, 2001. This mailing was followed 10 days later with a full mailing of the survey to those who did not reply on the Web during the first week. In early November, a follow-up post-card was mailed to those who had not responded to the Web survey by the 3rd. During the last week of November, a follow-up survey complete mailing was mailed to 10,323 graduates, and during the 2nd week of December, 2001, a final mailing was sent to chemistry and chemical engineering Ph.D.s only. By the cutoff date of January 20, 2002, ACS had received 3,599 usable responses.

**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 on 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. The certified graduate "has pursued and successfully completed a curriculum as proscribed in the guidelines for ACS-approved programs and that... has received the bachelor's degree." (ACS Committee on Professional Training, 1998).

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

The Technical Notes present methods for estimating sampling error and also explain certain discrepancies among some of the tables.

## 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

# 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.

**COMPARING SALARIES**

Often questions arise concerning women's salaries as compared with men's, or chemists' salaries as compared with chemical engineers.' These and similar comparisons require caution.

Statistical tests should be performed to determine whether observed differences in salaries of various sample groups could be mere chance occurrences resulting from peculiarities of the samples. Whether a difference in salaries is "statistically significant" depends not only on the magnitude of the difference but also on the sample sizes and the magnitudes of the sample standard deviations.

Discussion of statistical tests of significance may be found in *Introductory Statistics for Business and Economics*, by Thomas H. Wonnacott and Ronald J. Wonnacott, NY: Wiley, 1990, and in other similar texts.

**ESTIMATING SAMPLING ERROR FOR PERCENTS**

Percents in this report are derived from the sample. If the entire population had received and returned questionnaires, most estimates would be somewhat different. How much different? Although this question does not have an exact answer, the table below does provide some guidance. To use the table, find the column headed by the percent (p) derived from the sample, and find the row appropriate for the sample size (n). (Approximations for p and n may be used.) Note the number in that column and that row of the table.

This number from the body of the table measures the precision with which the sample percent estimates the percent of the entire population. Specifically, if this procedure is applied repeatedly, about 95 times out of 100, the population percent will differ from the sample percent by no more than the amount shown in the table.

**TABLE B–1. APPROXIMATE SAMPLING ERRORS FOR PERCENTS**

| n | p=10% or 90% | p=20% or 80% | p=30% or 70% | p=40% or 60% | p=50% |
|---|---|---|---|---|---|
| 50 | 8.3% | 11.1% | 12.7% | 13.6% | 13.9% |
| 100 | 5.9 | 7.8 | 9.0 | 9.6 | 9.8 |
| 200 | 4.2 | 5.5 | 6.4 | 6.8 | 6.9 |
| 500 | 2.6 | 3.5 | 4.0 | 4.3 | 4.4 |
| 1,000 | 1.9 | 2.5 | 2.8 | 3.0 | 3.1 |
| 2,000 | 1.3 | 1.8 | 2.0 | 2.1 | 2.2 |
| 5,000 | 0.8 | 1.1 | 1.3 | 1.4 | 1.4 |
| 10,000 | 0.6 | 0.8 | 0.9 | 1.0 | 1.0 |

In Table B-1a of the full report for example, 1,299 respondents classified as chemists indicated their highest degree as the bachelor's degree and their gender as female. The percent of this group who are employed full-time and permanent is 31 percent (p=31). A "95 percent confidence interval" for this percent may be approximated by taking n and p to be about 1000 and 30 percent. The above table shows an approximate sampling error of 2.8 percent. Hence, the 95 percent confidence interval is 28 percent to 34 percent. If estimates were made at this "level of confidence" from 100 similar samples, about 95 of the confidence intervals calculated from these samples would contain the true population percent.