American Chemical Society
Department of Career Services

STARTING SALARIES
Of Chemists and Chemical Engineers

2003

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

Starting Salaries of Chemists and Chemical Engineers 2003

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

American Chemical Society
1155 Sixteenth Street, NW
Washington, DC 20036

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 2003 new graduate study. Summaries of the survey findings were published in the April 19, 2004 issue of *Chemical & Engineering News* and the June 2004 issue of *Today's Chemist at Work*.

Janel Kasper-Wolfe, Research Associate in the Department of Career Services, conducted this year's survey and provided the tables for this report. Janel Kasper-Wolfe wrote the summary on the following pages. Special thanks go to the 3,493 new graduates who took the time to respond to this year's survey.

Ena Castro, *Assistant Director*
Department of Career Services

Summary of Findings

THE CLASS OF 2003 CONTINUED TO FEEL IMPACTS of a weakened job market. Employment status of new graduates in chemistry varied by degree with full-time permanent employment falling for new bachelor's and doctorate chemistry graduates. Starting salaries for new chemical engineers continued to outpace those for chemists. Starting salaries for B.S. chemical engineers are climbing while responses to this survey indicate M.S. and Ph.D.s experienced a downturn in salaries.

Simultaneously, the proportion of chemistry Ph.D.s accepting postdoctoral positions increased. A rise in the proportion of newly minted doctorates accepting postdocs often indicates a tightening job market. A related shift in the proportion of new graduates working in industry and government declined for new Ph.D. chemical professionals, negatively impacting median salaries for this group. While the proportion of new bachelor's and master's graduates employed in industry and government also decreased, median salaries for these groups remained fairly stable with bachelor's chemists actually witnessing an increase.

Pharmaceutical employment continues to dominate new chemists' employment opportunities. In fact, the top industrial employers for all three degrees were pharmaceutical manufacturers. Specifically, 29 percent of B.A./B.S. new graduates, 43 percent of M.S. new graduates, and 33 percent of new Ph.D.s found employment with pharmaceuticals. Analytical laboratories, contract research, and hospital and clinic laboratories also attracted new and inexperienced graduates with B.A./B.S. degrees in chemistry. In addition to pharmaceuticals, Ph.D.s found employment in a variety of industrial settings, including electronics, medical devices, biotech, and professional services. Unfortunately, the small number of new M.S. chemical professionals responding to the survey makes it difficult to draw conclusions about their specific placement across industrial employers.

Salaries for the Class of 2003: Means and Median

This section describes two summary statistics for salaries that help identify patterns in employment for new graduates. Overall, the mean and median salaries for new graduates in 2003 continue to point to a softened job market. Although not completely distressing, the figures certainly do not point to a strong employment situation for new graduates. Their starting salaries are influenced by a combination of factors including 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. In order to draw a clear-cut comparison, tables in this section identify mean and median starting salaries for new graduates with less than one year of experience.

Mean salaries represent the average starting salary. The mean often reflects very high individual salaries, which makes it a less accurate figure than the median for the evaluation of salary data. Means are, however, used in statistical analysis, and when analyzed in consideration with the median, can provide useful information about the group of interest – in this case new chemistry and chemical engineering graduates.

The median salary is used as the primary descriptive statistic in the majority of this report to avoid the distortions inherent in mean salary figures. The median salary represents the midpoint of the salary range for new graduates, where half of the salaries are above the midpoint and half are below.

Table 1 displays median salaries for all new graduates employed full-time by experience. The figures in Table 1 reflect current dollars. This information illustrates the relationship between degrees, length of experience, and a new graduate's starting salary. Median salaries for new graduates at all degree levels varied with their level of experience. In particular, starting salaries increased with both degree and length of experience. Newly minted Ph.D. chemists with more than 36 months of experience pulled in the highest median salary at $77,500. On average, Ph.D. chemists with less than a year of experience earned $63,250 a year, a difference of $14,250. The experience gap in starting salaries for those earning an M.S. in chemistry is similar to Ph.D.s at $9,500 ($44,500 under 12 months and $54,000 over 36 months).

TABLE 1. 2003 MEDIAN SALARIES FOR ALL NEW GRADUATES EMPLOYED FULL-TIME BY EXPERIENCE (MEDIAN SALARY IN CURRENT DOLLARS)

	Chemistry			Chemical Engineering		
	BA/BS	MS	PhD	BS	MS	PhD
Less than 12 months	$32,000	$44,500	$63,250	$52,000	$55,000	$72,000
12–36 months	$35,000	$45,000	$72,500	$52,000	$54,600	$76,000
More than 36 months	$39,000	$54,000	$77,500	$53,750	$69,250	$81,750

For B.A./B.S. chemists the difference was $7,000, with inexperienced new graduates averaging $32,000 and those with more than 36 months showing a median of $39,000.

Table 1 also reports median starting salaries for chemical engineers. However, drawing conclusions based on the small number of chemical engineers that responded is difficult. While salary comparison for B.A./B.S., M.S., and Ph.D. chemists and chemical engineers is possible, breaking each group down by the level of experience results in groups of less than 15, producing suspect medians.

Despite these interpretation complications, enough inexperienced B.S. and Ph.D. chemical engineers responded to examine the median salaries for this group. As usual, starting salaries for chemical engineers continue to outpace those of chemists. In general chemical engineers have higher median starting salaries than chemists, at all three-degree levels. Additionally, the gap between degree levels tends to be larger for chemical engineers. In 2003, for inexperienced respondents the gap between the median starting salaries for bachelor's and doctoral chemical engineers was $20,000. For new graduates with chemistry degrees the gap climbs to $31,250.

TABLE 2. 2003 MEAN SALARIES FOR INEXPERIENCED CHEMISTRY GRADUATES (MEAN SALARY IN CURRENT & CONSTANT DOLLARS)

	Mean Salary 2002	Mean Salary 2003	%Change Current	%Change Constant
Bachelor's	$32,657	$33,391	2.3	0.3
Master's	$45,458	$45,329	-0.3	-2.3
Doctorate	$63,614	$61,627	-3.1	-5.1

TABLE 3. 2003 MEAN SALARIES FOR INEXPERIENCED CHEMICAL ENGINEERING GRADUATES (MEAN SALARY IN CURRENT & CONSTANT DOLLARS)

	Mean Salary 2002	Mean Salary 2003	%Change Current	%Change Constant
Bachelor's	$47,842	$48,869	2.2	0.2
Master's	$56,938	$51,909	-8.8	-10.8
Doctorate	$76,278	$69,111	-9.4	-11.4

Tables 2 and 3 illustrate mean salaries for inexperienced chemistry and chemical engineering graduates. The information in both tables displays a slightly different picture than the figures in table one. The mean salaries point to a more weakened job market in relation to income. For both inexperienced chemistry and chemical engineering graduates, both M.S. and Ph.D. groups declined in current and constant dollars[1]. For doctorates, the mean salary decreased 3.1 percent in current dollars between 2002 and 2003. The decrease was magnified to 5.1 percent in constant dollars. The data shows a similar trend for new M.S. chemists with a -0.3 percent loss in current dollars and -2.3 percent in constant dollars. Average starting salaries increased over the year for inexperienced B.A./B.S. chemists in current dollars by 2.3 percent. However, once the CPI is considered the increase is washed out at 0.3 percent increase.

[1] The consumer price index measures cost of living increases for the U.S. and is used as an approximation for inflation. CPI for the period of October 2002 – October 2003 was 2.0 percent (http://www.bls.gov/cpi/home.htm).

Mean salaries for M.S. and Ph.D. chemical engineers show an even sharper decrease, in both current and constant dollars; -8.8 percent in current and -10.8 percent in constant dollars for M.S. and -9.4 in current and -11.4 in constant dollars for Ph.D. graduates. Similar to new B.A./B.S. graduates in chemistry, the increase for B.S. chemical engineers is countered by the increase in the CPI (2.2 in current versus 0.2 in constant dollars). The discrepancy between the median and mean, in addition to the low number of responses from this group, indicates that the figures are fairly volatile and, again, conclusions should be drawn with caution.

FIGURE 1. MEDIAN STARTING SALARIES FOR INEXPERIENCED CHEMISTS WORKING FULL-TIME (IN CURRENT DOLLARS 1975-2003)

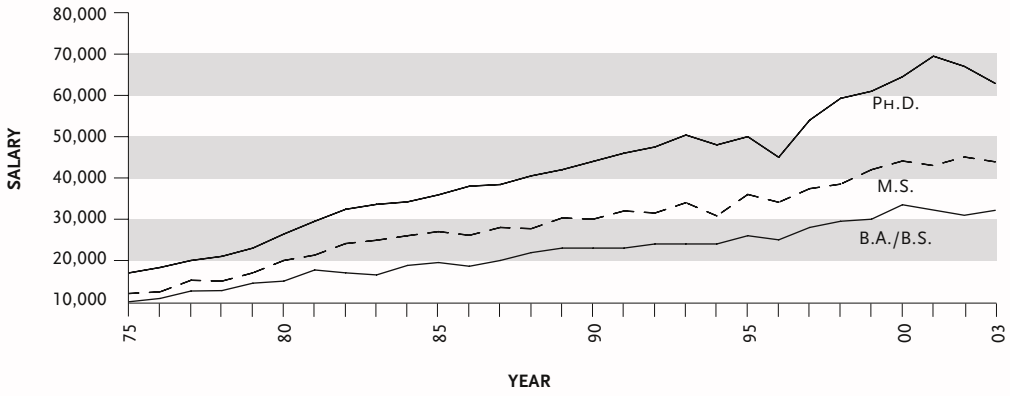
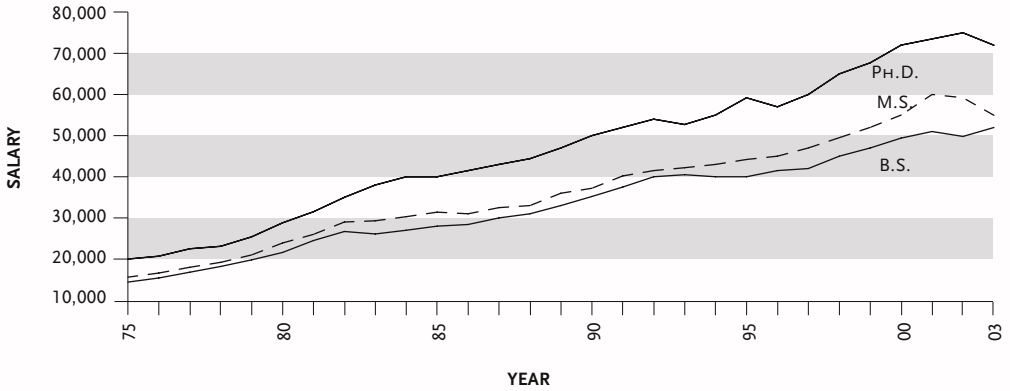


FIGURE 2. MEDIAN STARTING SALARIES FOR INEXPERIENCED CHEMICAL ENGINEERS WORKING FULL-TIME (IN CURRENT DOLLARS 1975-2003)



Figures 1 and 2 illustrate changes in median starting salaries of chemists and chemical engineers over time. For chemists, Figure 1 shows a steady pattern of increase for M.S. and Ph.D. chemists until the mid 1990's. At this point and until 1996, starting salaries began fluctuating almost yearly. Ph.D.'s starting salaries reached an all time high in 2001. However, upon examining current salary data for this group it is possible that overall, salaries are in a downturn. Median salaries for B.A./B.S. chemists appear relatively stable, although still lower than the peak figure in 2000.

Figure 2, which focuses on chemical engineers, exhibits similar patterns. Starting salaries for B.S. chemical engineers are stable and still climbing. Chemical engineers with M.S. and Ph.D.s may be experiencing a downturn in salaries. One distinction setting the starting salaries of chemists and chemical engineers apart is the relative closeness of B.S. and M.S. salaries for chemical engineers over time. Data from the last few years foreshadow a possible intersection for these groups.

Table 4 shows the same information from Figures 1 and 2 in table form. The same patterns observed in the graphs are apparent in Table 4.

The data in Tables 5 and 6 represent the percentiles of starting salaries for inexperienced full-time employed chemistry and chemical engineering graduates by degree. Data for both 2002 and 2003 are included. Table 5 focuses on new graduates in chemistry. Examination of each percentile for all three-degree levels shows a wide range of salary information. The difference in the 90th and 10th percentile for new B.A./B.S. chemists is $23,060. For M.S. chemists the difference is even larger at $30,000. The figure for Ph.D.s is $49,000. This is likely related to the different employment sectors in which new chemists find work. Chemists finding employment in industry are likely to have a considerably higher starting salary than those in academia.

It is worth noting that the standard deviation for Ph.D.s is a larger number than the same statistic for new B.A./B.S. and M.S.

TABLE 4. MEDIAN STARTING SALARIES FOR INEXPERIENCED GRADUATES 1975-2003 (BY DEGREE AND IN 1,000S OF CURRENT DOLLARS)

	Chemistry			Chemical Engineering		
Year	BA/BS	MS	PhD	BS	MS	PhD
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

TABLE 5. RANGES OF STARTING SALARIES OF INEXPERIENCED FULL-TIME EMPLOYED CHEMISTRY GRADUATES BY DEGREE: 2002 AND 2003 (IN CURRENT DOLLARS)

	DEGREE LEVEL					
	Bachelor's		Master's		Doctorate	
Salaries	2002	2003	2002	2003	2002	2003
90th Percentile	45,000	46,060	57,600	60,000	80,000	84,500
75th Percentile	38,000	38,000	53,000	55,000	75,000	76,750
50th Percentile	31,000	32,000	43,000	44,500	69,000	63,250
25th Percentile	26,000	27,000	33,500	37,250	53,000	45,000
10th Percentile	22,000	23,000	30,000	30,000	37,800	35,500
Mean	32,657	33,391	45,458	45,329	63,614	61,627
Count	337	363	35	46	85	84
Standard Deviation	10,138	8,817	11,291	11,796	18,398	18,209

TABLE 6. RANGES OF STARTING SALARIES OF INEXPERIENCED FULL-TIME EMPLOYED CHEMICAL ENGINEERING GRADUATES BY DEGREE: 2002 AND 2003 (IN CURRENT DOLLARS)

	DEGREE LEVEL					
	Bachelor's		Master's		Doctorate	
Salaries	2002	2003	2002	2003	2002	2003
90th Percentile	57,760	58,000	—	72,400	90,000	85,400
75th Percentile	54,000	55,500	63,000	60,000	83,000	80,000
50th Percentile	50,000	52,000	59,000	55,000	75,000	72,000
25th Percentile	44,000	45,000	55,625	36,000	71,000	60,750
10th Percentile	34,599	35,000	44,000	31,000	63,800	34,800
Mean	48,121	48,869	56,938	51,909	76,278	69,111
Count	417	119	8	11	25	18
Standard Deviation	7,346	9,754	10,009	14,550	9,718	15,695

chemists ($8,817, $11,796, and $18,209, respectively). The magnitude of the standard deviation indicates how spread out the cases are from the group average. In this case, the higher standard deviation for Ph.D.s indicates that the cases are more spread out from the mean than those for B.A./B.S. and M.S. chemists.

This affirms the above observation relating to the variation in employment sectors for new chemists being larger for doctorate level chemists.

Table 6 displays the same data for chemical engineering graduates. The standard deviations for B.S. and Ph.D.s were smaller than those found in the corresponding chemistry degrees. These differences reflected the fact that there is less variation in the employment sectors in which chemical engineers find work. Individual cases are more tightly located around the mean for new graduates in chemical engineering. However, this does not hold true for the previous year, likely resulting from the changing numbers of employed chemical engineers responding this year. A new graduate in chemical engineering at any degree level is less likely to work in academia than one in chemistry.

SALARY FACTORS

As discussed briefly above, salaries vary by the type and characteristics of the employer as well as the characteristics of the new graduates. For example, the size of the employer, the employer's geographic location, and, for B.A./B.S. chemists, certification from an ACS-approved program all influence a new graduate's starting salary.

For instance, median salaries are typically higher in private industry and lower in academic institutions for graduates at all degree levels (See Table A-5). For new Ph.D. chemists in 2003 the median starting salary in industry manufacturing was $73,500. On average the new Ph.D. grads in non-manufacturing start at $70,250. For those in academic institutions, however, the mean starting salary drops to $44,500.

The difference in median starting salaries across employment sectors impacts more than just the individual new graduate, it also influences other statistics discussed in this report. For example, overall starting salaries for Ph.D.s decreased from 2002 to 2003. Initially, the overall decrease in Ph.D. starting salaries appears alarming. However, an analysis of changing proportions of Ph.D. chemists working in academic versus industrial professions helps explain the decline. In other words, it is not that starting salaries for new Ph.D.s decreased per se. Rather, an increasing proportion took relatively lower paying academic positions. In particular, in 2002, 20.5 percent of new and inexperienced Ph.D.s found employment in academic positions, 69.9 percent worked in the industrial sector, and 9.6 percent in other positions. In 2003, the proportion of new Ph.D. graduates in academic positions increased to 35.3 percent and the proportion in industry fell to 61.2 percent. The remaining 3.5 percent found other employment opportunities.

In fact, once the median salaries are broken down by employment sector the median rises in most categories. For example, median starting salaries for industry increased across the board. New Ph.D. chemists in industry witnessed an increase of $2,000 on average. The increase in median starting salaries for B.A./B.S. chemists was $1,000 and $5,200 for M.S. chemists. Academic and governmental salaries increased in most cases as well. The only way to make sense of that seeming decline is to compare the proportions of new graduates in each employment sector by year. In a way, this change of employment distribution is another indicator of the softening market demonstrated by fewer jobs in industry.

Sex can be another factor influencing starting salaries. However, salary data by sex for the class of 2003 is inconclusive (See Tables A-3 and A-4). For two-degree categories, M.S. and Ph.D. chemical engineers, the low number of respondents made a comparison of medians by sex for the two groups meaningless. On average, new male and female B.A./B.S. chemists earned the same starting salary ($32,000). For both M.S. and Ph.D. chemists males reported higher starting salaries, $3,569 higher for M.S. and $11,500 higher for Ph.D. chemists. However, one must be extremely cautious in drawing conclusions here for a number of reasons. First, data collected last year exhibited different trends. The second reason for caution concerns the gender division of labor. Employment sectors are often gendered with different proportions of men and women finding work in different fields. For example, at the Ph.D. level 71 percent of male respondents versus 57 percent of female respondents worked in industry. Because industrial jobs usually pay higher salaries than other employment sectors, the median figure by sex is impacted.

As with chemists in general, the expansion of the pharmaceutical industry has dominated the growth of employment in industry for new graduates since 1990. Pharmaceuticals stood out as the single largest employer of new graduates in 2003, continuing a multi-year trend. Salary comparisons by the type of employer are challenging because of the small number of new graduates in some sectors, such as plastics and soaps/detergents. However, out of industrial employers large enough for comparisons, pharmaceuticals paid top median starting salaries for inexperienced chemists: $40,000 for bachelors, $55,500 for masters and $75,000 for doctorates.

In 2003, the number of chemical engineering respondents was too small to make meaningful comparisons across industrial sectors. However, it must be noted that chemical engineers are far more apt to work in industry than chemists.

Another factor contributing to a new chemist's or chemical engineer's starting salary is the size of their employer. Consistently, the size of the employer is a strong predictor of starting salaries. For new and inexperienced B.A./B.S. chemists the difference between the smallest employers,

less than fifty, and the largest, 25,000 or more, is $16,000 ($30,000 versus $46,000). In fact the $16,000 difference exists across degrees, although the lows and the highs for new and inexperienced M.S. and Ph.D. are certainly higher than those for B.A./B.S. chemists, $40,000 versus $56,000 and $68,000 versus $84,000 respectively.

The salary gap between small and large employers is likely to continue impacting the overall picture for new graduates as small employers maintain their status as a significant source of jobs. In 2002, for the first time in the history of this survey, the small employers (under 500 employees) led the way for hiring newly minted chemists. The proportion dipped just below the halfway point in 2003 with 48 percent of new graduates working for small employers (see Table A-9).

Regional factors also contribute a new graduate's starting salary (see Tables A-11 and A-20). However, regional differences in pay tend to be tied to the type and size of employer in the region. For example, if a region has a high number of large industrial companies then median starting salaries will likely be higher than a region with fewer industrial jobs. That being said, some regions still display higher median salaries than others. For B.A./B.S. chemists the Mid-Atlantic and New England offered the highest median salary at $34,000. The East South Central region exhibited the lowest figure at $28,392. The Pacific region showed the highest salary for new Ph.D. graduates at $71,700.

Median starting salaries for new B.S. chemical engineers were highest in the Mid-Atlantic ($54,000) and West South Central ($54,700). Salaries by region for M.S. and Ph.D. chemical engineers were spread too thin for a meaningful median comparison.

An academic factor frequently contributing to an increase in the median starting salaries of new B.A./B.S. chemistry graduates is ACS certification. Undergraduate students earning a bachelor's degree in chemistry have the option of pursuing an ACS certified degree, which involves an approved course of study from an ACS approved program. On average, ACS certified students reported an additional $3,000 to their annual starting salary ($31,000 versus $34,000). For both B.A./B.S. chemists and chemical engineers the highest median salaries are for those with an A average ($34,000 and $53,800) and those below a C average ($33,000 and $53,000).

GRADUATE AND POSTDOCTORAL STIPENDS

Median graduate stipends increased for all three degrees employed by academic institutions (see Table A-21). The median increase in graduate stipends for new bachelor's chemists only rose by $275, from $19,725 in 2002 to $20,000 in 2003. For new master's graduates stipends increased from a flat $19,000 to $20,000. Median stipends for academic postdoctoral fellowships for doctoral chemists were $32,000, an increase of $2,000.

It is likely that these increases, which occured after a decade of stagnant wages, are linked to a new standard set by the National Institutes of Health (NIH). The NIH stipends are $19,968 for graduate students and $34,200 for postdoctoral fellowships with less than one year of experience. Although the findings of this report indicate a much higher average for new chemistry graduates, the NIH standard sets a higher standard, which could be influencing the starting salaries of the new graduate respondents in this study.

A much smaller proportion of bachelor's and doctoral chemists found graduate or postdoctoral support in industry. In these cases the median was substantially higher at $23,250 for B.A./B.S. and $38,500 for new Ph.D. graduates. A number of new Ph.D.s found postdoctoral fellowships in government; the median salary for this group was $55,125, or much higher than the median for academic postdoctoral fellowships.

BACHELOR'S CHEMISTS AND THEIR FIRST JOBS

Not surprisingly, given the discussion above about salary factors, median starting salaries for new bachelor's graduates tend to be very dependent on the type of job he or she has obtained (see Table A-10). Continuing 2002's top paying work function, new B.A./B.S. graduates working in development and design had the highest median salary ($38,662). Eight percent of inexperienced B.A./B.S. chemists in full-time positions worked in development and design. The highest proportion works in production and quality control (36%). The remaining new B.A./B.S. chemists work in teaching (10%), management (5%), research (26%), professional service (4%) and other (11%).

POSTGRADUATION EMPLOYMENT STATUS

Table 7 addresses the post graduation employment status of chemists and chemical engineers. Employment status of new graduates varied by degree with full-time employment falling for new bachelor's and Ph.D. graduates. Simultaneously, the proportion of Ph.D.s accepting postdoctoral positions increased. As of October 6, 2003, 23.3 percent of B.A./B.S. chemists found full-time and permanent employment, a 2.2 percentage point decrease from 2002. The proportion in graduate positions increased by 2.6 percentage points to 49 percent. Of all new bachelor's chemists, 7.4 percent were unemployed and seeking, up from 5.8 percent in 2002.

M.S. chemists with full-time permanent employment increased to 41.1 percent in 2003, up from 38.2 percent in 2002. Overall, the proportion of M.S. chemists unemployed and seeking increased from 4.6 percent to 9.8 percent for the one-year period.

In 2003, the proportion of Ph.D.s in postdoctoral positions increased from 40.4 percent in 2002 to 50.6 percent, a substantial increase of 10.2 percentage points. Concurrently, the percentage in full-time employment dropped by 8.1 percentage points, from 44.8 percent in 2002 to 36.7

TABLE 7. POSTGRADUATION STATUS OF CHEMISTRY AND CHEMICAL ENGINEERING GRADUATES: OCTOBER 11, 2003

Major and Employment Status	Bachelor's	Master's	Doctorate
CHEMISTRY			
Full-time employed:			
Permanent	23.3%	41.1%	36.7%
Temporary	8.9%	6.4%	5.2%
Part-Time employed:			
Permanent	2.3%	1.9%	0.5%
Temporary	5.6%	4.9%	2.1%
Graduate student, postdoc	49.0%	32.5%	50.6%
Unemployed and seeking employment	7.4%	9.8%	4.4%
Unemployed and not seeking employment	3.4%	3.4%	0.5%
TOTAL*	99.9%	100.0%	100.0%
Unemployment rate as of the week of 10/6/03	7.7%	10.0%	4.9%
Number of responses	2,296	265	387
CHEMICAL ENGINEERING			
Full-time employed:			
Permanent	53.0%	32.1%	61.1%
Temporary	4.4%	3.8%	3.7%
Part-Time employed:			
Permanent	4.2%	0.0%	0.0%
Temporary	2.1%	3.8%	0.0%
Graduate student, postdoc	22.5%	50.9%	27.8%
Unemployed and seeking employment	11.2%	5.7%	7.4%
Unemployed and not seeking employment	2.6%	3.8%	0.0%
Total*	100.0%	100.1%	100.0%
Unemployment rate as of the week of 10/6/03	11.4%	7.6%	7.4%
Number of responses	383	53	54

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

The unemployment rate calculation only includes respondents in the workforce, which excludes those unemployed and not seeking employment.

percent. A rise in the proportion of newly minted Ph.D.s accepting postdocs often indicates a tightening in the job market. In fact, 43 percent of those in postdoctoral positions claimed they accepted them because full-time permanent positions were unavailable. Overall newly minted Ph.D.s in chemistry also experienced a slight decrease in unemployment, from 4.7 percent in 2002 to 4.4 percent in 2003.

A total of 53 percent of B.S., 32 percent of M.S., and 61 percent of Ph.D. chemical engineers found full-time permanent employment. Unemployed and seeking fell 2.5 percentage points to 11.5 percent in 2003 for B.S. and 2.3 percent to 5.7 percent for M.S. chemical engineers. However, for Ph.D.s the rate of those unemployed and seeking rose from 2.9 percent in 2002 to 7.4 percent in 2003. The small number of M.S. and Ph.D. chemical engineers responding to the survey likely skewed the employment figure. New B.S. chemical engineers were more likely to report part-time employment, 6.3 percent versus 3.8 percent at the M.S. level and none for Ph.D.s. The actual unemployment rate was highest for M.S. chemists, followed by B.S. chemists (7.7%) and Ph.D. chemists (4.9%). B.S. chemical engineers showed the highest unemployment rate (11.4%) while M.S. and Ph.D. chemists showed little difference, 7.6 percent and 7.4 percent, respectively.

PLANS FOR ADVANCED STUDY

Table 8 displays information charting the fall plans of new bachelor's chemistry and chemical engineering graduates and Table 9 displays detailed information about those plans. About 49 percent of those in chemistry are planning to pursue further studies full-time. Of those, 47 percent plan to study chemistry or biochemistry and 34.8 percent will pursue graduate education in medicine, dentistry, or pharmacy. The remainder plan to study chemical or biochemical engineering (1.7%), other engineering (1.1%), other physical sciences (1.9%), life sciences (4.4%), business/management (.7%), education (2.6%), the law (1.2%), or some other field (4.5%).

TABLE 8. PLANS FOR FURTHER STUDY OF BACHELOR'S CHEMISTRY & CHEMICAL ENGINEERING GRADUATES: FALL 2003 PLANS

Plans	Chemistry	Chemical Engineering
Total further studies		
Full-time	48.7%	22.1%
Part-time	4.6%	6.2%
No plans for further studies	46.8%	71.7%
Total*	100.0%	100.0%
Number of responses		

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

Only 4.6 percent of new B.A./B.S. grads in chemistry are pursuing part-time studies. Of those chemistry or biochemistry (30.4%), medicine, dentistry, or pharmacy (22.6%), or education (12.7%) were the top areas of study.

The higher proportion of chemical engineers with full-time permanent employment compared to new chemistry graduates at the bachelor's level discussed above is a long-standing workforce trend for chemical engineers relative to the pursuit of advanced study. Specifically, because chemical engineers are applied scientists their professionalization process is more likely to be complete at the bachelor's level. This is not to say that no B.S. chemical engineers pursue advanced education. In fact, 23.2 percent of the class of 2003 indicated they have plans for further graduate studies. In comparison with new bachelor's chemists, B.S. chemical engineers are less likely to continue in graduate education and more likely to earn a higher starting salary. Bachelor's level chemical engineers that do pursue graduate education are likely to continue with chemical or biochemical engineering. In particular, in 2003, 59.3 percent of new graduates indicated continued education in chemical or biochemical engineering.

THE CHANGING FALL PLANS OF BACHELOR'S CHEMISTS

Figure 3 displays trends in the post graduation plans of bachelor's chemistry graduates since 1987 to the current year. The data presented compares plans to pursue employment, graduate education in chemistry, or graduate education in another field. In the past, the post-graduation plans for bachelors' chemists involved about one-third entering the workforce immediately while two-thirds continued their graduate education. In the mid-nineties

TABLE 9. FIELDS OF STUDY OF CHEMISTRY AND CHEMICAL ENGINEERING BACHELOR'S GRADUATES: FALL 2003

Plans	Chemistry	Chemical Engineering
FULL-TIME STUDY		
Chemistry and biochemistry	47.0%	5.9%
Chemical or biochemical engineering	1.7%	59.3%
Other engineering	1.1%	10.5%
Physical science	1.9%	1.2%
Life science	4.4%	1.2%
Medicine, dentistry, or pharmacy	34.8%	8.1%
Business or management	0.7%	5.8%
Education	2.6%	0.0%
Law	1.2%	2.3%
All others	4.5%	5.8%
Total*	99.9%	100.1%
Number of responses	1,124	86
PART -TIME STUDY		
Chemistry of biochemistry	30.4%	4.2%
Chemical or biochemical engineering	1.0%	33.3%
Other engineering	1.0%	12.5%
Physical science	7.8%	0.0%
Life science	8.8%	4.2%
"Medicine, dentistry, or pharmacy"	22.6%	4.2%
Business or management	5.9%	29.2%
Education	12.7%	4.2%
Law	1.0%	0.0%
All others	8.8%	8.3%
Total*	100.0%	100.1%
Number of responses	102	24

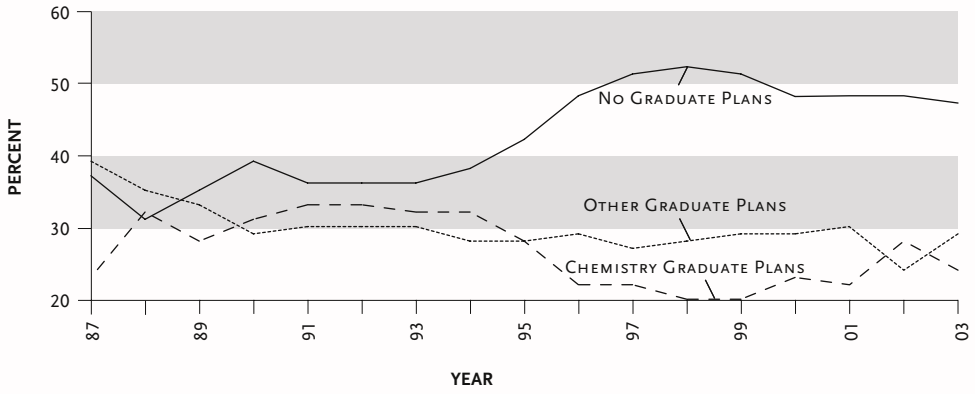
**Note: Any deviation from 100 is due to rounding.*

post-graduate plans of new chemists shifted with an increasing proportion going into employment. Over time the proportion of new chemists forgoing graduate education for employment has increased and stabilized at just under half for the last four years.

Figure 4 shows in detail the post-graduation plans for the class of 2003. Of the 47 percent of new B.A./B.S. chemistry graduates with no graduate plans, 83 percent were employed and 17 percent were still seeking employment on October 6, 2003. Looking in further detail, of the 83 percent employed a large proportion worked in manufacturing (38%). Of new B.A./B.S. graduates, 28 percent found employment in non-manufacturing, 12 percent at a university or college, six percent in medical schools, six percent in elementary or high school, eight percent in the federal government, two percent in the military, and two percent indicated they were self-employed.

Of new B.A./B.S. graduates in chemistry, 29 percent reported pursuing graduate education in fields other than chemistry. The largest proportion indicated medicine as their field of study (41%). Dentistry/pharmacy appeared as the second largest field of study for this group. Life sciences (9%), education (6%), engineering (5%), other physical sciences (4%), business (2%) and the law (2%) represented other fields of study for chemistry graduates. Approximately 9 percent of new B.A./B.S. graduates in chemistry reported fields other than those listed above.

FIGURE 3. POST GRADUATION PLANS OF BACHELOR'S CHEMISTRY GRADUATES: 1987–2003



BACHELOR'S GRADUATES CERTIFIED TO ACS FROM APPROVED PROGRAMS

In 2003 small differences existed between B.A./B.S. graduates with ACS certification. Specifically, the proportion of certified graduates pursuing higher education (51%) slightly outpaced those without certification (47.3%). The lower unemployment rate for certified graduates (6.8% versus 7.5%) indicates another small difference between the two groups.

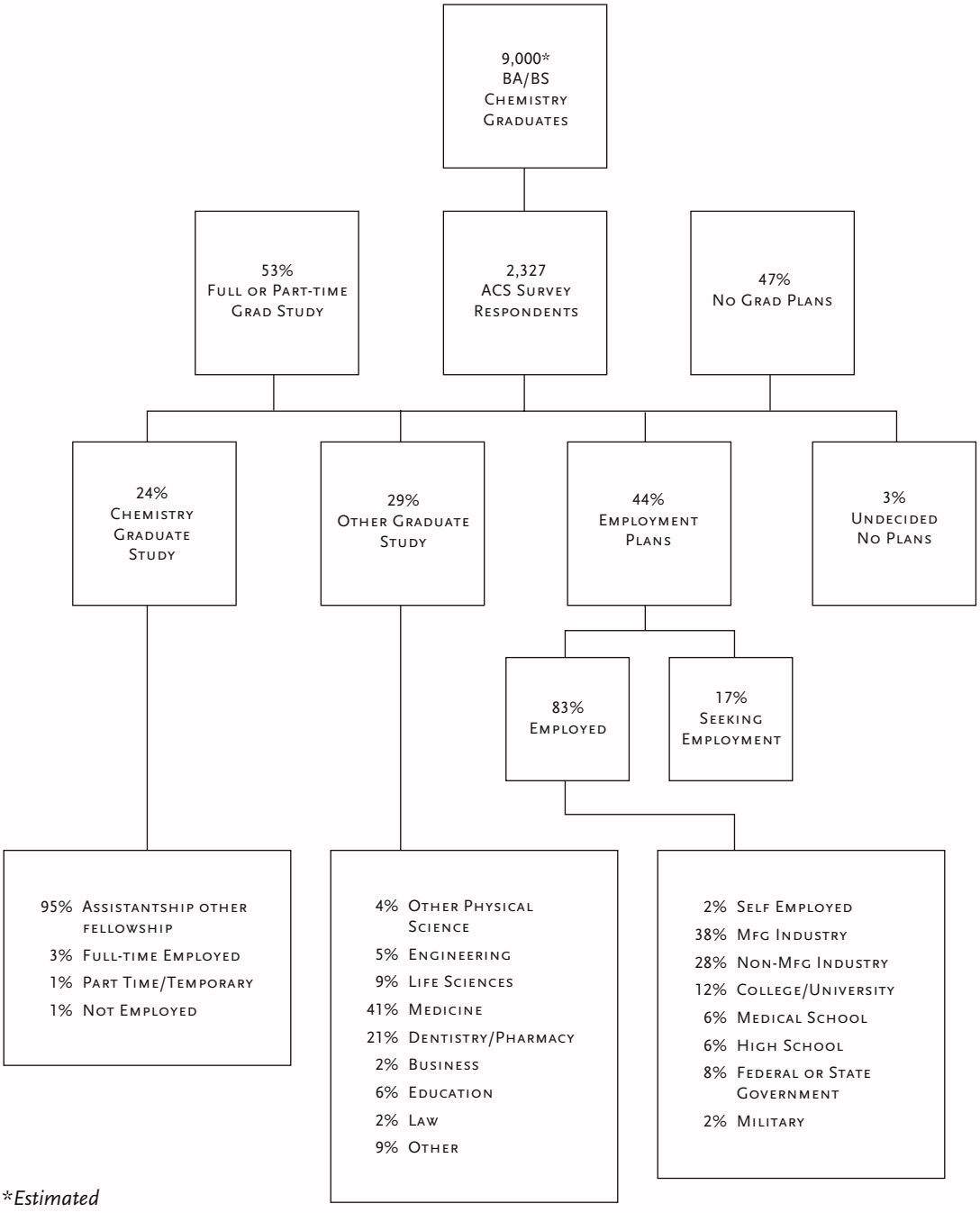
DEMOGRAPHIC COMPOSITION OF NEW GRADUATES

SEX

In general, this survey has charted increases in the participation of women at all degree levels for chemistry graduates (see table B-1a). However, because women disproportionately responded to the survey, these figures are higher than the real proportion of women and men graduating with chemistry degrees. Women are increasingly represented in both undergraduate and graduate chemistry programs. Regardless of this increase, women are still over represented as our respondents.

Women comprised 57 percent of those responding with B.A./B.S. degree in chemistry. Men made up 43 percent of the same group. Results show 55 percent of M.S. chemists responding to the survey are women and 45 percent were men. The Ph.D. level shows a larger proportion of men (55.4 percent), however, women are over-represented at 44.6 percent (See "Extent of Coverage," pg. 18). This is anticipated given the fact that in general men are still over represented among those earning Ph.D.s in chemistry while the B.A./B.S. and M.S. levels are closer to parity.

FIGURE 4. POST GRADUATION PLANS OF 2003 BACHELOR'S CHEMISTRY GRADUATES



**Estimated*

Data on sex distribution for chemical engineering degrees show similar trends (see Table B-7a). 47.8 percent of B.S. chemical engineers responding to the survey were women and 52.2 percent were men. At the M.S. level, women represented 35.8 percent of respondents and men 64.2 percent. Finally, for Ph.D.s, women represented 58.2 percent and men 41.8 percent. The data at the Ph.D. level shows a significant over representation of women, more so than at the other levels, and should be interpreted carefully.

CITIZENSHIP

Citizenship for new chemistry and chemical engineering graduates varied by degree with the largest proportion of U.S. citizens found in the categories of B.A./B.S. chemistry and chemical engineering graduates. This reflects general trends in graduate education in science, engineering, and technology fields.

In particular, U.S. natives comprised 90 percent of new B.A./B.S. graduates in chemistry (see Table F-1) and 91.5 percent for chemical engineers (see Table F-5). These proportions reflect very little change from 2002 figures (89% and 93.8%, respectively). Naturalized citizens (5.7%), permanent residents (3.2%), and temporary visas (1.1%) made up the remaining categories for B.A./B.S. chemists. For bachelor's chemical engineers, the remaining categories were naturalized citizens (3.6%), permanent residents (2.3%), and temporary visas (2.6%).

U.S. citizens comprised smaller proportions of new M.S. and Ph.D. graduates for both chemistry and chemical engineering. At the M.S. level for new chemistry graduates, the break down is U.S. native (62.8%), naturalized citizens (7.7%), permanent residents (7.3%), and temporary visas (22.2%). The Ph.D. level shows similar proportions: U.S. natives (62.1%), naturalized citizens (3.3%), permanent residents (7.9%), and temporary visas (26.6%).

New chemical engineering graduates at the M.S. and Ph.D. levels show higher proportions of temporary visas (41.5% and 36.4%) and lower proportions of U.S. natives (36.4% and 58.2%). However, as in previous demographic discussions the low number of respondents from these groups makes it impossible to generalize these findings to the larger group.

RACE AND ETHNICITY

The demographics for the race and ethnicity of the class of 2003 are very similar to the class of 2002 (see table F-3 for chemistry and Table F-6 for chemical engineers). In most cases, proportions of most groups changed by less than a full percentage point. In 2003, Asians represented 8.8 percent of the bachelor's chemists and 7.0 percent of chemical engineers. The proportion of Asians increases at the M.S. degree level to 23.4 percent for chemists and 41.5 percent for chemical engineers. At the Ph.D. level, Asians comprise 23.7 percent of new chemistry grads and 32.1 percent of chemical engineers.

American Indians, Hispanics, and Blacks continued to be under-represented while Whites were over-represented. In particular, new Black chemistry grads made up five percent for chemistry and 6.3 percent for chemical engineering. The proportion of Hispanics for chemistry was 3.8 percent and 5.2 percent for chemical engineering. Whites comprised 79.2 percent and 78.3 percent of the groups, respectively. The race and ethnicity breakdown for M.S. chemists is Black (7.3%), Hispanic (6.9%), White (58.6%) and other (2.7%). The M.S. group for chemical engineering shows slightly different figures: Black (3.8%), Hispanic (11.3%), and White (43.4%). Finally at the Ph.D. level for new chemistry graduates, the race and ethnicity breakdown is Black (3.1%), Hispanic (3.6%), White (66.8%), and other (2.6%). Once again the breakdown for Ph.D.s of chemical engineering look different than chemistry: Black (0), Hispanic (1.9%), White (60.4%), and other (3.8%).

Scope and Method

OBJECTIVES

The 2003 New Graduate Study (Starting Salary Survey) is the 53rd 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* and *Today's Chemist at Work*.

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 2002-2003 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, 2002 and June, 2003. For the first time, the Department of Career Services collected names from non-ACS approved schools. We received 307 additional names of new graduates. The survey was mailed out from November through February, 2003. Questionnaires were mailed to those graduates whose names had been provided and who had U.S. addresses.

EXTENT OF COVERAGE

Survey questionnaires were mailed by first class mail on 11/6/2003, to 10,620 graduates. Approximately one week after the initial mailing, a postcard reminder was sent, then a second questionnaire and cover letter were sent to non-respondents on November 18, 2003. A third full mailing to non-respondents was sent on January 26, 2003. By the cutoff date of February 15, 2004, ACS had received 3,500 usable responses. Respondents could complete the survey by mail or on the web at: http://chemistry.org/careers.html.

A total of 6,793 B.A./B.S. chemistry graduates received a survey, 49.5 percent female, 50.1 percent male, and .4 percent unknown. A total of 993 surveys were sent to M.S. graduates, 45.7 percent female and 54.3 percent male. A total of 1090 new Ph.D.s in chemistry received the survey, 33 percent female and 67 percent male. A total of 1,760 surveys were sent to new chemical engineering graduates at the B.S. (1,243), M.S. (315), and Ph.D. (202) levels. Chemical engineers receiving the survey at the bachelor's level were of comprised 37 percent female and 63 percent male. Of the M.S. chemical engineers, 27.9 percent were female and 72.1 percent were male. Finally, for new graduates with a Ph.D. in engineering receiving the survey, 20.3 percent were female and 79.7 percent were male.

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, 1,308 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 23 percent (p=23). A "95 percent confidence interval" for this percent may be approximated by taking n and p to be about 1000 and 20 percent. The above table shows an approximate sampling error of 2.50 percent. Hence, the 95 percent confidence interval is 20.5 percent to 25.5 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.

List of Tables for Class of 2003

SALARIES OF RESPONDENTS

Appendix A: Survey Questionnaires

Appendix B: Reprint of *Mixed News for Grads* by Janel Kasper-Wolfe

Appendix C:
Reprint of *2003 Starting Salary Survey* by Michael Heylin

ACS Career Services: Workforce Publications

SALARIES The Society surveys annually that ACS membership, gathering detailed information on member chemists and chemical engineers living in the U.S. The reports based on the survey contain statistical tables describing the respondents' employment status, employer, work function, specialty, salary and demographic characteristics. Reports are available each year from 1973 through the current year.

STARTING SALARIES Starting Salaries. ACS also surveys new graduates in chemistry and chemical engineering each year and publishes reports detailing the graduates' employment status, post-graduate plans, starting salaries, and other employment and demographic characteristics. Reports are available for each year from 1975.

MILLENNIUM SERIES A series of reports drawn from special studies that detail members' employment characteristics at the turn of the millennium.

Lifetimes in Chemistry 1999–2000—A report drawn from the 1999 study of ACS members, aged 50 through 69.

ChemCensus 2000—A look at the decade of the 1990s through comparing data from the 1990, 1995, and 2000 ACS censuses of working members.

Women Chemists 2000—A look at the decade of the 1990s through comparing data on women chemists from the 1990, 1995, and 2000 ACS censuses of working members

Industrial Chemists 2000—A look at the decade of the 1990s through comparing data on industrial chemists from the 1990, 1995, and 2000 ACS censuses of working members

Academic Chemists 2000—A look at the decade of the 1990s through comparing data on academic chemists from the 1990, 1995, and 2000 ACS censuses of working members.

Early Careers of Chemists 2001—A detailed look at the education and early careers of ACS members under age 40 drawn from survey conducted in 2001.

For prices and ordering information, please call or write:

ACS Office of Society Services
1155 16th Street NW
Washington, DC 20036
Phone: 800.227.5558 or 202.872.4600

For all of ACS Career Services: http://chemistry.org/careers

ISBN 0–8412–3902–9