American Chemical Society

2007 STARTING SALARIES OF CHEMISTS AND CHEMICAL ENGINEERS

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of Chemists and Chemical Engineers

2007

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 Society Services

Contents

Acknowledgements

For more than three decades, the American Chemical Society has prepared an annual survey of new graduates. This year, under the direction of the ACS Committee on Economic and Professional Affairs Subcommittee on Surveys, the 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 2007 study. Summaries of the survey findings were published in the June 2, 2008 issue of *Chemical & Engineering News*, a copy of which appears as an appendix in this report.

The survey was conducted by Jeffrey R. Allum, Ed.D., Research Manager, and Gareth Edwards, Research Associate. Michelle Peters cleaned, edited, and analyzed the data. She also wrote this report. Her services were invaluable. Blake Stenning of Pittny Creative was instrumental in ensuring a consistent and attractive graphic layout and design. 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

Summary of Findings

The Starting Salaries of Chemists and Chemical Engineers: 2007 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 2007 resembles graduates of the past couple of years in many respects, indicating that the workforce has stabilized somewhat. This is good news after a slight downturn in salaries in the early part of the decade.

- Salaries for recent graduates in chemistry and chemical engineering are rising. The mean salaries have risen faster than inflation at all degree levels. From 2006, the average starting salary for chemistry bachelor's recipients increased by 5.6%, while chemical engineering graduates reported an 8.6% increase.
- Factors related to salaries include level of degree, amount of work experience, employment sector, region of the country, size of employer, and whether the student completed an ACS-certified program in chemistry.
- Postdoctorates in chemistry and chemical engineering reported annual salaries of approximately $37,000. The primary factor determining the median salary of postdoctorates was the employment sector of the position. Chemistry postdocs reported earning over $55,000 while those in academia earned only about $37,000.
- Approximately half of all chemistry bachelor's were pursuing higher education in the fall of 2007. Of these students, most were enrolled full-time and 41% will remain in the field and study chemistry. About a quarter of chemical engineering B.S. recipients enrolled in graduate school. Most were working full-time in permanent positions.

Salaries for the Class of 2007: Means and Medians

The class of 2007 in chemistry and chemical engineering reports higher salaries than last year in a variety of employment sectors, indicating a stable job market. Salaries varied only slightly depending on the type of employer, type of work, and employer size.

Starting salaries for recent chemistry graduates with less than a year of work experience were up in 2007. The average salary for inexperienced bachelor's recipients was $37,923, or 5.6% higher than the average starting salary in 2006. However, after adjusting for inflation, the 2007 average is only slightly higher (1.5%) than the prior year. The increase in salary was 5.0% for chemistry M.S. recipients with little or no work experience (.9% after adjusting for inflation). Among newly-minted chemistry graduates, only Ph.D. recipients had a significant gain in earning power after inflation (5.2%).

TABLE 1. 2007 MEAN SALARIES FOR INEXPERIENCED CHEMISTRY GRADUATES (MEAN SALARY IN DOLLARS)

	Mean Salary 2006	Mean Salary 2007	%Change Current	%Change Constant
Bachelor's	$35,922	$37,923	5.6	1.5
Master's	$48,160	$50,554	5.0	0.9
Doctorate	$62,541	$68,339	9.3	5.2

Note: CPI 12/06 – 12/07 = 4.1%

TABLE 2. 2007 MEAN SALARIES FOR INEXPERIENCED CHEMICAL ENGINEERING GRADUATES (MEAN SALARY IN DOLLARS)

	Mean Salary 2006	Mean Salary 2007	%Change Current	%Change Constant
Bachelor's	$54,034	$58,671	8.6	4.5
Master's	$57,661	$66,238	14.9	10.8
Doctorate	$77,248	$81,325	5.3	1.2

Note: CPI 12/06 – 12/07 = 4.1%

The job market was strong in the late 1990s to 2000 and salaries for scientists and engineers rose quickly during this period. From 2002 to 2004, salaries in chemistry stagnated, even declining in terms of real dollars. However, data from 2005-2007 indicates that starting salaries for chemists graduating with a bachelor's or master's degree are continuing to steadily increase. On the other hand, although doctorate recipients experienced a 9.3% decrease in starting salaries from 2005 to 2006, in 2007 they appear to be back on track with a 9.3% increase.

Chemical engineering graduates also experienced a modest increase in starting salaries in 2007. Inexperienced bachelor's recipients in this field earned an average of $58,671. This was almost $5,000 higher than the average reported in 2006 and represents an increase of 4.5% after accounting for inflation. Graduates with a master's degree in chemical engineering reported a larger increase (10.8%) compared to last year. The average salary for those with less than a year's work experience was $66,238. Ph.D.s in this field accepted jobs with an average starting salary of $81,325, or 1.2% higher than 2006 grads, after inflation.

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

Similar to chemistry graduates, chemical engineers had experienced a decline in the real dollar value of their starting salaries for novices from 2000 to 2004. However, data from 2005-2007 indicates that starting salaries for chemists graduating with a bachelor's degree continued to steadily increase. On the other hand, master's recipients experienced a 3.8% decrease in starting salaries from 2005 to 2006, while reporting a 14.9% increase in starting salaries for 2007. Doctorate recipients experienced a similar trend. A 5.7% decrease was reported from 2005 to 2006, while in 2007 starting salaries were reported to be back on track with a 5.3% increase.

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. 2007 MEDIAN SALARIES FOR ALL NEW GRADUATES EMPLOYED FULL-TIME BY EXPERIENCE (MEDIAN SALARY IN DOLLARS)

	Chemistry			Chemical Engineering		
	B.A./B.S.	M.S.	Ph.D.	B.S.	M.S.	Ph.D.
Less than 12 months	$36,700	$48,000	$75,000	$58,200	$65,529	$84,000
12–36 months	$38,640	$47,000	$70,000	$60,000	$62,750	$80,000
More than 36 months	$40,000	$64,000	$60,000	$60,000	$58,000	$76,000

Table 3 displays the median full-time salaries for new graduates by degree field, degree level, and number of months on the job. One would expect that as degree level and job tenure increases, salary would also generally increase. This only proved to be the case for the bachelor's recipients. Master's recipients in chemistry who were at their job for less than a year had a median salary of $48,000, whereas those with one to three years of experience reported a median salary of $47,000, and those who were most experienced reported salaries around $64,000. Chemical engineering master's recipients reported a salary decrease as length of time on the job increased. Those who were new to their jobs had a median salary of $65,529, whereas those with more experience had salaries around $58,000. Salaries of Ph.D.s in chemistry and chemical engineering also appeared to decrease as length of time on the job increased. Chemistry Ph.D.s who were at their job for less than a year had a median salary of $75,000, whereas the more experienced Ph.D.s had salaries around $60,000. Similarly, chemical engineering Ph.D.s new to their jobs had a median salary of $84,000, whereas the more experienced Ph.D.s had salaries around $76,000.

A similar phenomenon was also found in 2006 among master's recipients in chemical engineering and chemistry Ph.D.s, so this finding may warrant an explanation. 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. An alternate explanation for this anomaly is that those with work experience are 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. 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 (one hopes).

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 pay for those earning degrees in chemical engineering was higher than that of those who studied chemistry. Bachelor's in chemistry typically earned between $36,700 for less than one year experience and $40,000 for more than three years of experience. Holders of bachelor's degrees in chemical engineering had salaries that were more than 50% higher and ranged between $58,200 for beginners to $60,000 for the most experienced.

The salaries in these two fields become more similar as education level increases. Typical salaries for chemistry master's were $48,000 for those just out of graduate school, while graduates with an M.S. in chemical engineering earned $65,529, or 37% more than their chemistry M.S. counterparts. Ph.D.s in chemical engineering reported salaries 12% higher than chemistry Ph.D.s. The typical salaries for doctorates in chemistry with more than three years of experience were around $60,000 and were in the mid-$70,000 for chemical engineers.

The graphs on this page show the median starting salaries by level of degree for chemists (Figure 1) and chemical engineers (Figure 2) over the past 30 years. After slightly leveling off in the earlier part of this decade, starting salaries for chemistry graduates continued to rise in 2007 for all degree levels. As mentioned above, the 2007 increase exceeded the inflation rate. This continues the larger 30-year trend that indicates a modest rise in salaries over time. The rise has been slightly steeper for master's than for bachelor's recipients, and particularly so for Ph.D.s compared to others.

Similarly, starting salaries for chemical engineers were up again in 2007. The difference between degree levels was smaller for chemical engineers when compared to chemists. While those with an M.S. earned more than those with a B.S., the difference was small (about 13% in 2007). Ph.D.s earned more than master's, with the typical starting salary of $84,000 – about 28% higher than those with master's degrees. In chemistry, master's recipients earned $48,000, or almost 30% more than those with bachelor's degrees ($36,700) and Ph.D.s earned about $75,000 – 56% more than master's recipients.

FIGURE 1. MEDIAN STARTING SALARIES FOR INEXPERIENCED CHEMISTS WORKING FULL-TIME, 1975–2007 (IN CURRENT DOLLARS)

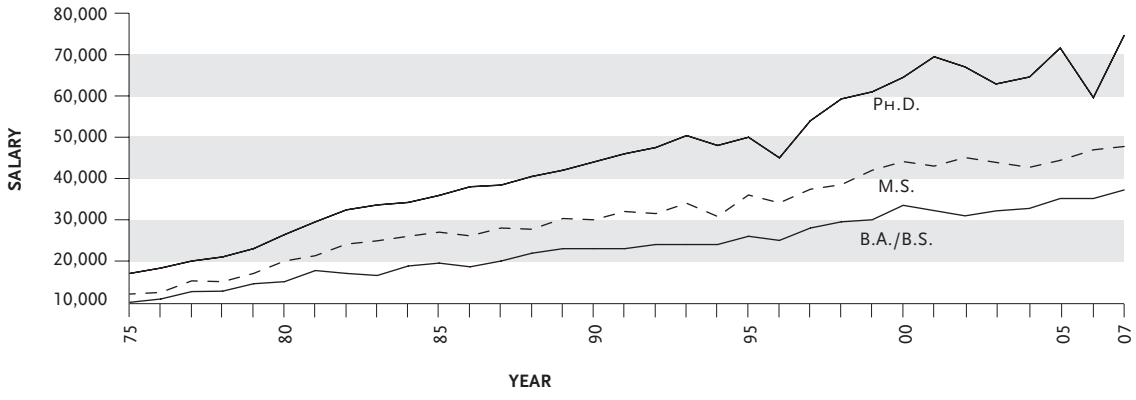


FIGURE 2. MEDIAN STARTING SALARIES FOR INEXPERIENCED CHEMICAL ENGINEERS WORKING FULL-TIME, 1975–2007 (IN CURRENT DOLLARS)

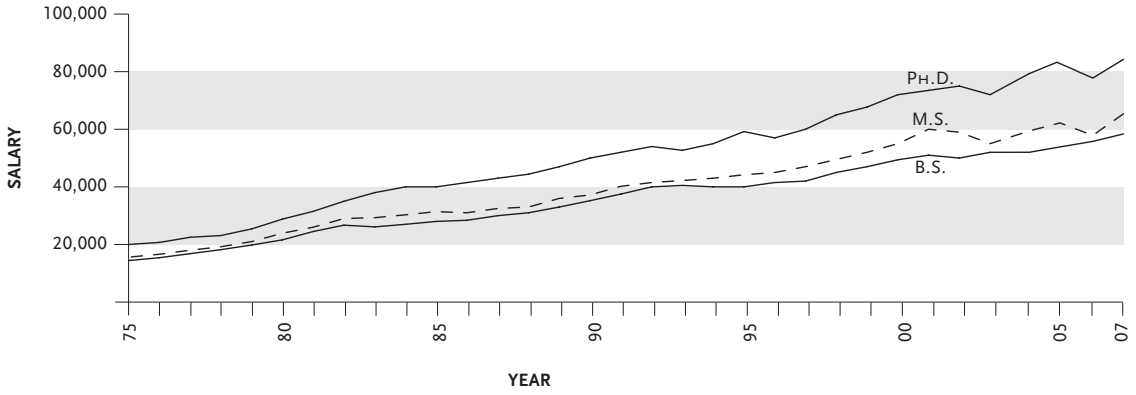


TABLE 4. MEDIAN STARTING SALARIES FOR INEXPERIENCED GRADUATES 1975 – 2007 (BY DEGREE AND IN 1,000S OF CURRENT DOLLARS)

	Chemistry			Chemical Engineering		
Year	B.A./B.S.	M.S.	Ph.D.	B.S.	M.S.	Ph.D.
1975	10.0	12.0	17.0	14.4	15.6	20.0
76	10.8	12.4	18.3	15.4	16.6	20.7
77	12.6	15.2	20.0	16.8	18.0	22.5
78	12.7	15.0	21.0	18.2	19.2	23.1
79	14.5	17.0	23.0	19.8	21.0	25.4
1980	15.0	20.0	26.4	21.6	23.9	28.8
81	17.7	21.3	29.5	24.5	26.0	31.5
82	17.0	24.1	32.4	26.7	29.0	35.0
83	16.5	24.9	33.6	26.1	29.3	38.0
84	18.8	26.0	34.2	27.0	30.3	40.0
1985	19.5	27.0	35.9	28.0	31.4	40.0
86	18.6	26.1	38.0	28.4	31.0	41.5
87	20.0	28.0	38.4	30.0	32.5	43.0
88	21.9	27.7	40.5	31.0	33.0	44.4
89	23.0	30.3	42.0	33.0	36.0	47.0
1990	23.0	30.0	44.0	35.2	37.2	50.0
91	23.0	32.0	46.0	37.5	40.2	52.0
92	24.0	31.5	47.5	40.0	41.5	54.0
93	24.0	34.0	50.4	40.5	42.2	52.7
94	24.0	30.8	48.0	NA	NA	NA
1995	25.0	36.0	50.0	40.0	44.2	59.2
96	25.0	34.1	45.0	41.5	45.0	57.0
97	28.0	37.5	54.0	42.0	47.0	60.0
98	29.5	38.5	59.3	45.0	49.8	65.0
99	30.0	42.0	61.0	47.0	52.0	67.7
2000	34.3	44.1	64.5	49.4	55.0	72.0
01	32.2	43.0	69.5	51.0	60.0	73.5
02	31.0	45.0	67.0	50.0	59.0	75.0
03	32.0	44.5	63.3	52.0	55.0	72.0
04	32.6	43.3	65.0	52.0	59.3	78.6
2005	35.0	45.0	72.0	54.0	62.2	83.0
06	35.0	47.4	60.0	55.8	58.0	78.0
07	37.0	48.0	75.0	58.2	65.5	84.0

Table 4 shows that 2007 salaries for both chemists and chemical engineers were higher than they have ever been (with the one exception of B.S. chemical engineers, whose median salary was down by about 1% from 2006). When evaluating these trends, it is important to consider not just the current dollar increase, but whether the increase is greater than inflation. Rises above the inflation rate are the only increases that indicate real growth.

Tables 5 and 6 show a complete set of summary statistics for starting salaries of chemistry and chemical engineering graduates in the last two years (2006 and 2007). 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 very close to the median (50th percentile) for all degree levels. This indicates a normal distribution of salaries with few outliers.

Table 5 compares salary ranges grouped in percentiles for each type of degree for 2006 and 2007 chemistry graduates. By displaying the 10th and 90th percentiles, we get a better idea of the complete range of salary offers accepted. For chemistry bachelor's recipients, 80% of full-time starting salaries fell between $27,300 and $50,972. Most master's recipient salaries ranged between $36,000 and $67,000, while the corresponding majority of Ph.D.s' salaries ranged from $41,450 to $87,100. As degree level increases, salary increases. With an increase in average salary comes a larger range of salaries. However,

TABLE 5. RANGES OF STARTING SALARIES OF INEXPERIENCED FULL-TIME EMPLOYED CHEMISTRY GRADUATES BY DEGREE: 2006 AND 2007 (IN DOLLARS)

	B.S.		M.S.		Ph.D.	
Salaries	2006	2007	2006	2007	2006	2007
90th Percentile	48,000	50,972	60,877	67,000	86,807	87,100
75th Percentile	40,000	42,000	57,654	60,000	80,000	83,000
50th Percentile	35,000	36,700	47,362	47,000	60,000	74,250
25th Percentile	30,000	30,000	42,000	40,000	44,662	56,750
10th Percentile	25,632	27,300	32,829	36,000	38,991	41,450
Mean	35,922	37,923	48,160	50,554	62,541	68,339
Count	355	358	42	39	74	76
Standard Deviation	9,444	11,236	10,593	14,773	19,249	17,938

it is important to note that while the salary range between the 90th and 10th percentiles is only $23,672 for bachelor's and is $45,650 for Ph.D.s, these differences are proportionate to the typical salary.

The full range of chemical engineering starting salaries for 2006 and 2007 are shown in Table 6. The average salary for recent chemical engineering B.S. graduates was $58,671, and 80% of salaries fell in the range between $48,100 and $71,261. M.S. recipients averaged $66,238, and most salaries were between $51,800 and $92,200. Chemical engineering Ph.D. salaries were generally in the range of $65,700 and $101,000. The average was $81,325.

Although chemical engineers' salaries were higher, for the most part, their salary ranges were smaller than those of chemists. Even though these statistics are based on a smaller number of respondents than the data collected from chemists, the standard deviations are smaller than those of chemist salaries (only 17 to 22% of their respective means). This suggests that chemical engineers may be more homogeneous in terms of salary distribution when compared to chemists.

TABLE 6. RANGES OF STARTING SALARIES OF INEXPERIENCED FULL-TIME EMPLOYED CHEMICAL ENGINEERING GRADUATES BY DEGREE: 2006 AND 2007 (IN DOLLARS)

	B.S.		M.S.		Ph.D.	
Salaries	2006	2007	2006	2007	2006	2007
90th Percentile	64,957	71,261	79,000	92,200	97,178	101,000
75th Percentile	60,000	64,000	70,211	71,250	87,838	90,000
50th Percentile	55,769	58,200	58,027	65,529	78,000	84,000
25th Percentile	49,310	52,000	50,545	56,700	65,470	72,500
10th Percentile	38,880	48,100	30,000	51,800	50,988	65,700
Mean	54,034	58,671	57,661	66,238	77,248	81,325
Count	121	141	10	12	22	43
Standard Deviation	11,105	9,795	14,899	12,880	18,165	17,710

SALARY FACTORS

The data displayed in Tables 5 and 6 show that even when 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 $46,000 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 (Appendix Tables A–5 and A–14). For example, the median salary for Ph.D.s working for private companies in manufacturing was $80,000 and was $75,000 for non-manufacturing private employers. By comparison, the median Ph.D. salary in universities was only $45,250.

The type of work the employer does or product that it manufactures also has a bearing on salary (Appendix Tables A–8 and A–17). The median salary for recent chemistry bachelor's recipients employed in pharmaceuticals was $40,000 compared to the overall median of $37,500. Similarly, master's recipients reported $60,000 in this field (versus $52,000 overall), and Ph.D.s reported $84,000 compared to $79,250 across all types of employers.

Number of employees (Appendix Tables A–9 and A–18) and geographic region (Tables A–11 and A–20) are also relevant to earnings. Small businesses with fewer than 50 employees had lower average salaries than corporations and universities with a larger workforce. The median salary for chemistry bachelor's recipients was $30,000 when there were 50 employees

or fewer. For employers with a workforce of 25,000 or more the median was $45,412. Also, those in the Pacific states, mid-Atlantic states, and New England typically earn more than those in the central plains. The data for geographic variations in salary among chemical engineers shows a slightly different pattern, although the data set is significantly smaller and therefore less useful for broad observations.

Employee characteristics contributing to starting salary may include primary job duties (Appendix Tables A–10 and A–19), degree specialization (Table A–13), and whether or not the individual has received certification (Table A–12). Those teaching typically earn less than those engaged in research, development, and design. Graduates specializing in organic chemistry averaged salaries higher ($45,137 for B.S.'s and $60,000 for M.S.'s) than those in other fields ($36,700 for B.S.'s and $48,000 for M.S.'s overall).

The certification process is an option offered to undergraduates pursuing an ACS-approved program of study which, upon completion, offers them an ACS-certified degree. In 2007, students with a bachelor's degree certified by ACS reported average salaries that were about $750 higher than non-certified degrees ($37,400 compared to $36,650). While certified employees generally earn more than non-certified, this difference is most apparent with certain types of employers. In academia for example, bachelor's recipients typically earned $7,000 more when they were certified. However, manufacturing employers paid about the same, regardless of certification.

Another important comparison in salary differences is between men and women. Because degree level and type of employer are determining factors of starting salary, Tables A–15 and A–16 show the starting salaries of men only and women only within these subcategories. However, by breaking down the salaries to such a specific level of detail, we lose some power in making comparisons, as the number of respondents in each category is small. That being said, in some employment sectors and degree levels there are small differences between men and women. This is likely attributable to some other factor such as type of work, number of employees, or geographic area. It remains important to evaluate men's and women's salaries each year and to investigate when 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 41% of chemistry Ph.D.s were employed in private industry. That proportion was 49% in 2006 and 70% in 2005. These salary factors 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. Chemists in both fields were awarded approximately the same amounts in graduate and postdoctoral stipends in 2007 and 2006. When factoring in a 4.1% rise in the CPI, however, only stipends for B.S. chemists and chemical engineers showed gains (of 2% and 4% respectively), while all others earned less (from 2% less for Ph.D. chemists to 11% less for M.S. chemical engineers). Chemical engineers at all levels reported receiving greater stipend amounts than did chemistry graduates.

Graduate support was reported most often by those working in academia. However, there are chemists receiving graduate stipends who are employed in private industry, particularly recent bachelor's recipients. These stipends tend to be higher than the average, with a median of $25,000 in non-manufacturing and $38,000 in manufacturing. These private stipends may be associated with more traditional work arrangements, whereas those employed by universities may be 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 academic, government, and industry, it is important to note that a substantial number of recent college graduates planned to remain out of the workforce to continue their education.

FIGURE 3. POST-GRADUATION PLANS OF BACHELOR'S CHEMISTRY GRADUATES: 1987–2007

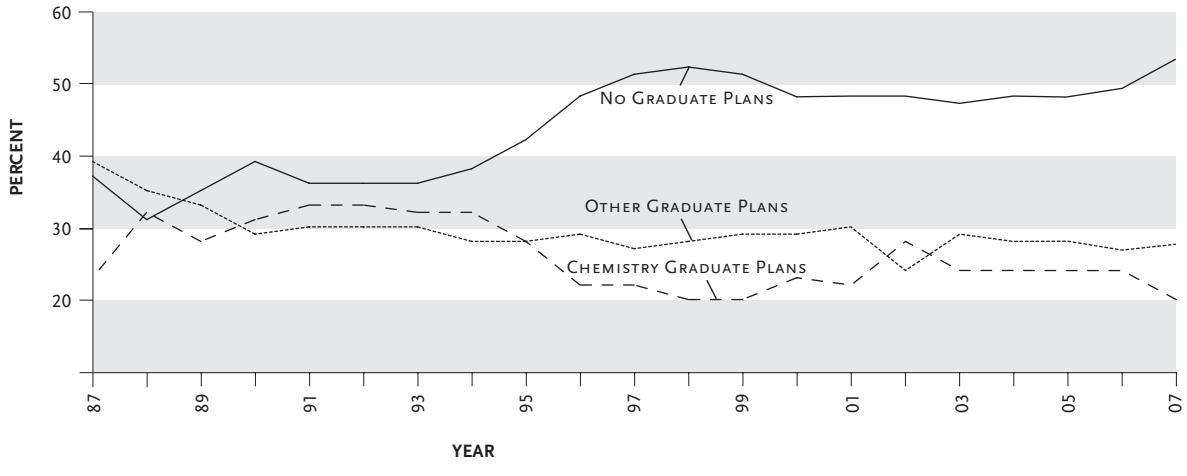
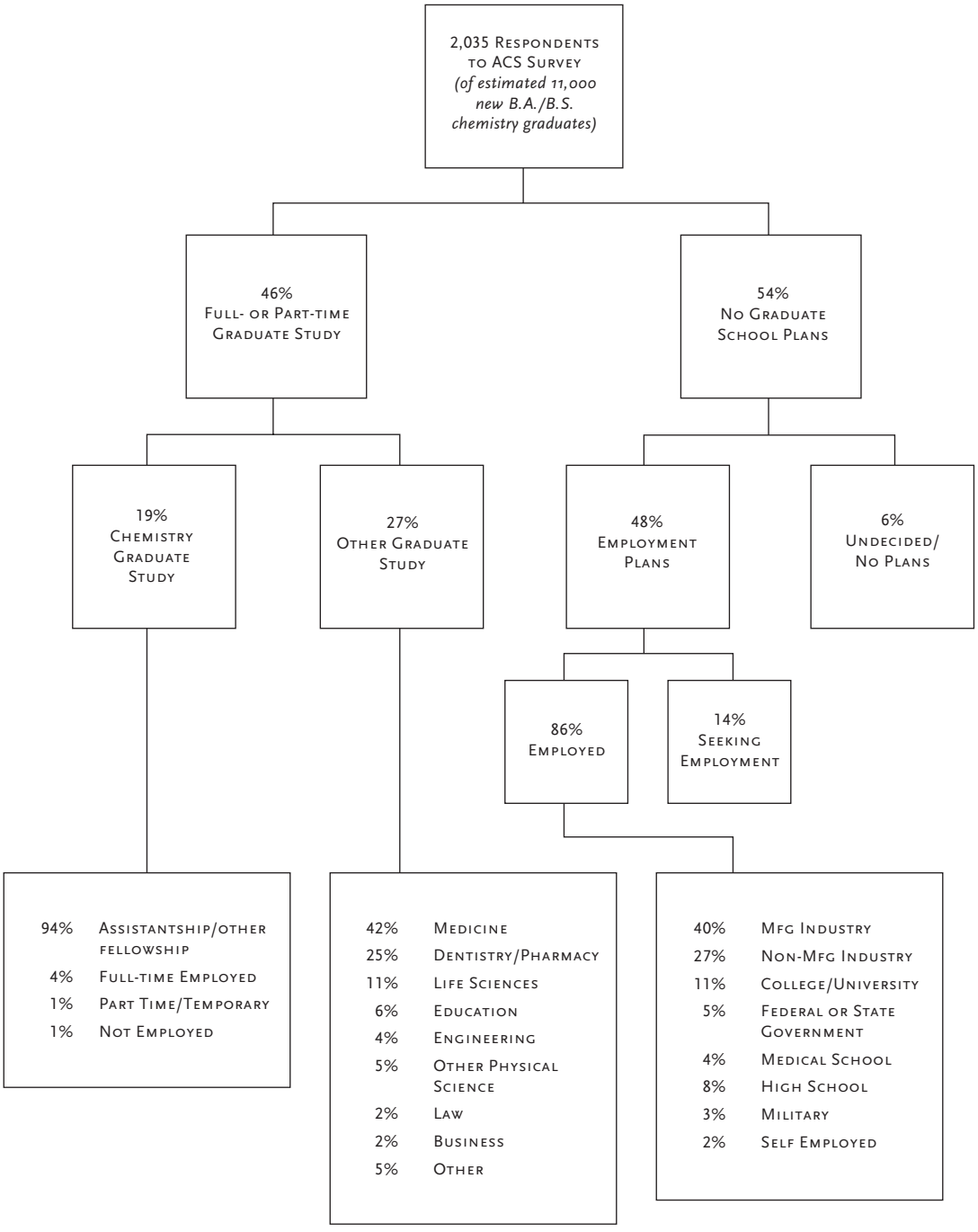


FIGURE 4. POST-GRADUATION PLANS OF 2007 BACHELOR'S CHEMISTRY GRADUATES



Approximately one-half of chemistry bachelor's plan to attend graduate school. As Figure 3 shows, this proportion is down markedly compared to a generation ago. As recently as 17 years ago, three-quarters of graduates continued their education immediately following graduation. Most of this drop occurred in the mid- to late-1990s when many 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 recipients working toward chemistry graduate degrees increased (from 20% in 1999 to 29% in 2002). Over the last several years, the trend to pursue postgraduate education has been fairly stable.

A detailed breakdown of the plans of the undergraduate class of 2007 is shown in Figure 4. Slightly more than half of the graduates have no plans to continue school. Of the individuals with employment plans, 86% were employed as of October 2007. The most common sector of employment was private industry (40% in manufacturing and 27% in non-manufacturing), but substantial numbers were working at colleges and universities (11%) and for the government (5%). Fourteen percent had not yet found employment at the time of this survey and 6% had not yet made post-graduate plans.

Of the 46% of graduates who did intend to continue their education, 19% will do so within the field of chemistry. Most of these students (94%) will receive support through assistantships or other fellowships, and a small number will also work to help pay for their education. The remaining graduates will pursue degrees in disciplines other than chemistry. Medicine (42%), dentistry/pharmacy (25%), and life sciences (11%) were the most common fields of study.

PLANS FOR ADVANCED STUDY

More specific data on the graduate school plans of chemistry and chemical engineering bachelor's recipients is provided in Table 7. Decreases in graduate school enrollments were reported by both chemistry and chemical engineer graduates. Forty-three percent of all recent chemistry bachelors' recipients were enrolled in graduate school full-time in the fall of 2007. An additional 3.3% chose to enroll in a graduate program on a part-time basis. These results represent an 8.5% and 2.9% decrease, respectively, from last years' levels, possibly indicating that bachelor's recipients are opting to enter the workforce instead of pursuing advanced studies. Approximately 54% reported having no plans for further studies.

TABLE 7. PLANS FOR FURTHER STUDY OF BACHELOR'S CHEMISTRY & CHEMICAL ENGINEERING GRADUATES: FALL 2007

Plans	Chemistry	Chemical Engineering
Total further studies		
Full-time	43.0%	19.8%
Part-time	3.3%	2.5%
No plans for further studies	53.7%	77.7%
Total*	100.0%	100.0%
Number of responses	2,013	323

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

Chemical engineering graduates, on the other hand, were less likely to continue their education. Over three-fourths (78%) of B.S. recipients 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 in graduate school full-time in the fall of 2007 (20%) is slightly lower than the proportion in 2006 (24%). Special attention should be paid to these figures in the future.

Students who decide to continue their education tend to remain within the field of their undergraduate degrees. About 41% of chemistry graduates continuing full-time graduate programs studied chemistry or biochemistry and 57% of chemical engineers remained in chemical or biochemical engineering. An undergraduate degree in chemistry also appears to provide an ample background for those who want to enter the medical field: 41% of these full-time students studied medicine, dentistry, or pharmaceutical science. Similarly, the medical fields were the second-most-popular choice (20%) for chemical engineer recipients pursuing graduate degrees full time.

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. Thirty-three percent of chemistry undergraduates who pursued a graduate degree part-time remained in field. A significant number (11.4%) entered medical school, chose to pursue life science studies (17.1%), or were studying to become teachers (17.1%). Less than 5% of chemistry graduates who pursue part-time education were in fields outside of the physical sciences, medicine, business, education, and law. Chemical engineers resembled chemists in this respect. Of those who were part-time students, approximately 13% were in some other field. Over three-fourths were studying chemical engineering or some other type of engineering (87.5%).

POST-GRADUATION EMPLOYMENT STATUS

Table 7 illustrates that less than half of chemistry bachelor's recipients continued their education while only about a fifth of college graduates in chemical engineering did so. Table 9 shows whether the remaining graduates were working or seeking work. This table also displays the employment status of those with advanced degrees. Just over one-quarter (27.3%) of recent bachelor's recipients in chemistry had found permanent full-time employment by October 2007. About 11% percent worked temporary full-time jobs and 7% had part-time work. Most of the part-time employed chemists were working part-time at a temporary job.

Many chemistry master's graduates surveyed had no plans to continue their education. Just under half were employed full-time (45.8% permanently and 6.7% in temporary positions), about 7% part-time, and 33.5% remained enrolled in graduate programs. Less than half of chemistry doctorates found postdoctoral appointments, about 40% found full-time permanent employment, and 3.4% found temporary full-time employment. Very few worked part-time. These figures were similar to those of the class of 2006.

When compared to chemists, chemical engineers were more likely to find full-time permanent employment at all education levels (from 59% to 71% found full-time permanent work, compared to a range of 27% to 46% among chemistry graduates). Along with the higher salaries, this is another indicator of the strong employment opportunities for chemical engineers.

TABLE 8. FIELDS OF STUDY OF CHEMISTRY AND CHEMICAL ENGINEERING BA/BS GRADUATES: FALL 2007

Plans	Chemistry	Chemical Engineering
FULL-TIME STUDY		
Chemistry and biochemistry	41.3%	3.1%
Chemical or biochemical engineering	1.0%	56.9%
Other engineering	0.8%	9.2%
Physical science	2.8%	3.1%
Life science	5.8%	1.5%
Medicine, dentistry, or pharmacy	40.9%	20.0%
Business or management	1.0%	0.0%
Education	2.6%	1.5%
Law	1.3%	1.5%
All others	2.4%	3.1%
Total*	100.0%	100.0%
Number of responses	945	65
PART-TIME STUDY		
Chemistry or biochemistry	32.8%	0.0%
Chemical or biochemical engineering	4.3%	50.0%
Other engineering	2.9%	37.5%
Physical science	4.3%	0.0%
Life science	17.1%	0.0%
Medicine, dentistry, or pharmacy	11.4%	0.0%
Business or management	2.9%	0.0%
Education	17.1%	0.0%
Law	2.9%	0.0%
All others	4.3%	12.5%
Total*	100.0%	100.0%
Number of responses	70	8

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

Any data concerning employment and unemployment status should be interpreted with caution. The ACS data are based on a relatively small portion of all graduates, and rates of less than 10% are highly susceptible to fluctuations. It is possible that unemployed graduates were disproportionately represented among our respondents. Another factor that may impact the unemployment rate measured here is the date of data collection. Graduates were asked to report on their employment status as of the first week of October 2007. Given that this survey is administered several months after graduation, it is possible that many of the unemployed degree recipients eventually found employment. Most of these individuals were not working prior to graduation, and it is likely that a number of them will simply need more time to find work.

TABLE 9. POSTGRADUATION STATUS OF CHEMISTRY AND CHEMICAL ENGINEERING GRADUATES: OCTOBER 1, 2007

Major and Employment Status	B.S	M.S.	Ph.D.
CHEMISTRY			
Full-time employed			
Permanent	27.3%	45.8%	40.3%
Temporary	11.4%	6.7%	3.4%
Part-Time employed			
Permanent	1.4%	1.7%	0.6%
Temporary	5.8%	5.0%	1.9%
Graduate student, postdoc	43.1%	33.5%	46.3%
Unemployed and seeking employment	7.8%	3.9%	5.0%
Unemployed and not seeking employment	3.2%	3.4%	2.5%
Total*	100.0%	100.0%	100.0%
Number of responses	2,034	179	320
CHEMICAL ENGINEERING			
Full-time employed			
Permanent	68.4%	58.5%	70.9%
Temporary	2.5%	0.0%	2.5%
Part-Time employed			
Permanent	0.6%	0.0%	1.3%
Temporary	1.5%	1.9%	0.0%
Graduate student, postdoc	19.9%	35.8%	20.3%
Unemployed and seeking employment	5.5%	0.0%	3.8%
Unemployed and not seeking employment	1.5%	3.8%	1.3%
Total*	100.0%	100.0%	100.1%
Number of responses	326	53	79

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

BACHELOR'S GRADUATES CERTIFIED IN ACS-APPROVED PROGRAMS

ACS has approved over 600 chemistry programs to offer an ACS-certified bachelor's degree. Many undergraduate departments offer several degree tracks, and ACS-certified programs have extra requirements and the most demanding curriculum.

The certification indicates that the student has completed a degree from a nationally recognized department. The extra preparation associated with an ACS-certified degree is valued by employers and graduate admissions committees. In 2007, 39% of all bachelor's recipients surveyed had completed an ACS-certified degree program.

In 2007, the student who pursued this rigorous specialization was more likely to enter graduate school: 49.6% of certified 2007 graduates were enrolling in graduate programs in the fall of 2007 compared to 44.5% of non-certified graduates (Appendix Table B–4b). These certified students were also more dedicated to the field of chemistry. Of those bachelor's recipients who pursued full-time graduate studies, 52.4% of certified students chose chemistry programs compared to just 20.8% of non-certified graduates (Table C–5).

Because more certified students than non-certified students enter graduate school, this impacts the representation of certified bachelor's recipients in the workforce. Only 37% of ACS-certified bachelor's recipients were employed full-time compared to 40% of non-certified graduates. Certified students were also less likely to be unemployed (7% compared to 8% of non-certified graduates).

DEMOGRAPHICS OF NEW GRADUATES

GENDER

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

At all levels of education, women represent 50.2% of all degree recipients in the 2007 ACS survey. However, the representation of women in chemistry decreases as degree level increases. This study found that 55.2% of bachelor's and 54.1% of master's recipients were female. The real difference occurred at the doctorate level, where only 37.9% were female.[1]

1. The ACS numbers on the representation of women are comparable to NCES data compiled of all college graduates. In 2006, NCES found that 57.6% of bachelor's, 60.0% of master's, and 49.0% of Ph.D.s were female. Data from 2007 are not yet available. These numbers were retrieved from the WebCASPAR online database <http://webcaspar.nsf.gov>.

According to our survey results, the representation of women in higher levels of chemistry may be on the rise. Approximately 46% of female bachelor's recipients in 2007 were enrolled in graduate programs compared to 48% of male graduates. However, among those with master's degrees, 34% of men were continuing their education, compared to 35% of females. While these differences are small, the disparity between men and women in chemistry at the highest levels of chemistry may be narrowing.

Comparing salaries by gender is important in order to evaluate whether women's salaries compare favorably to men's. As mentioned earlier, Appendix Tables A–6 and A–7 (for chemistry) and Tables A–15 and A–16 (for chemical engineering) display these data by employment sector and degree level, which are important determining factors for salary. However, great care should be used in comparing these tables. Ideally, we would also standardize results by other factors shown to have an impact on salary, such as region of the country and area of specialization. As it is, the numbers in each cell are small so we may not dissect these data further. Given these qualifications, it appears as though there is little if any difference between men's and women's salaries. In some employment sectors and degree levels, men earn slightly more than women. But just as often, women earn slightly more than men.

CITIZENSHIP

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

Among bachelor's, the proportion of non-U.S. students in chemistry is small. Of all ACS respondents, just 2% of bachelor's recipients in chemistry were foreign citizens in the U.S. on temporary visas. However, 22% of master's recipients and 36% of Ph.D.s in chemistry were in the U.S. on temporary visas (Appendix 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. Therefore, we may be less likely to receive survey responses from non-U.S. graduates.[2]

The representation of native U.S. citizens, naturalized citizens, and permanent residents among chemistry graduates is similar to recent years and varies widely by degree level. Eighty-six percent were native citizens, 9% naturalized, and 4% permanent residents at the bachelor's level. For those

2. According to the NCES data, 3.8% of bachelor's, 32.7% of master's, and 37.2% of Ph.D. recipients in chemistry held temporary visas in 2004. For chemical engineering graduates in 2004, 6.1% of bachelor's, 46.0% of master's, and 49.7% of Ph.D. recipients held temporary visas. Data for 2005 are not yet available. <http://webcaspar.nsf.gov>

with an M.S., the proportions were 68% native-born, 6% naturalized, and 5% permanent resident. Among Ph.D. chemists, just 55% were native to the U.S., 3% naturalized, and 6% permanent residents.

Numbers in chemical engineering were quite similar to those of chemists. For chemical engineering bachelor's recipients, 90% were U.S. native, 6% were naturalized, 2% permanent residents, and just 3% were in the U.S. on temporary visas. Among master's recipients, the representation was 68% U.S. native, 9% naturalized, 13% permanent residents, and 9% temporary visa. At the doctorate level, 59% of recipients were native-born U.S. citizens, 3% were naturalized citizens, 8% were permanent U.S. residents, and 31% had temporary visas.

RACE AND ETHNICITY

The racial composition of the chemistry (Appendix Table F–3) and chemical engineering (Appendix Table F–6) class of 2007 is similar to recent years. Whites represent the majority of all graduates. White graduates comprised 74% of chemistry and 79% of chemical engineering bachelor's recipients. Among holders of master's degrees, 62% of chemists and 54% of chemical engineers were white. At the Ph.D. level, 57% of chemists and 59% of chemical engineers were white.

In 2007, Asians represented approximately 13% of bachelor's recipients in chemistry, and 11% of those in chemical engineering; 20% of master's recipients in chemistry, and 27% of those in chemical engineering; and 32% of doctorates in chemistry, and 29% of those in chemical engineering. 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.

Black students are underrepresented in these fields, particularly at the graduate level. In fact, when broken down by gender, the number of black master's and Ph.D. graduates who responded to our survey was in the single digits. In the field of chemistry, blacks represented 5% of all bachelor's degree recipients; 7% at the master's level, and 5% at the Ph.D. level. At the undergraduate level, there were a larger proportion of women in this racial category: 4% of female chemists and 7% of female chemical engineers were black.

To put these figures in perspective, in the general population of the United States, whites represented 66% of the population in 2007.[3] Approximately 12.3% were black, 4.3% Asian, and 15.1% Hispanic. Native Americans, other races, and those with more than one race represented the remaining 2.3%.

3. Source: U.S. Census Bureau, 2007 American Community Survey. <http://factfinder.census.gov> Note that proportions for whites and blacks are of non-Hispanics. Hispanics may be of any race.

Scope and Method

OBJECTIVE

The 2007 New Graduate Study (Starting Salary Survey) is the 57th in the series of annual surveys on the employment and future plans of new graduates in chemistry and chemical engineering conducted by the American Chemical Society. A summary of the results of these surveys appears annually in *Chemical & Engineering News*.

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 2006–2007 academic year. The survey covers bachelor's, master's, and doctoral degree recipients. In addition, since 1975, the survey provides information on graduates' gender, 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 Accreditation Board for Engineering and Technology (formerly Engineer's Council for Professional Development) provided names and addresses of students who graduated between July 2006 and June 2007. 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 in early October 2007. A reminder postcard was mailed a week later. A second mailing was sent in November, followed by a reminder postcard. Of 13,052 surveys mailed, a total of 3,014 usable responses were received, resulting in a 24% response rate. Respondents could complete the survey by mail or on the Web at: http://chemistry.org/careers.html. Women represented 50.2% of the survey respondents, while 49.8% were men.

Technical Notes

DISCREPANCIES AMONG TABLES

Because not all individuals responded to all of the survey items, some pairs of tables contain totals that should be identical but are not. For example, one table may group Ph.D.s by 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.

DEFINITIONS

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

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

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

GEOGRAPHIC REGIONS

Pacific
- Alaska
- California
- Hawaii
- Oregon
- Washington

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

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

West South Central
- Arkansas
- Louisiana
- Oklahoma
- Texas

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

East South Central
- Alabama
- Kentucky
- Mississippi
- Tennessee

Middle Atlantic
- New Jersey
- New York
- Pennsylvania

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

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

ISBN 978–0–8412–7251–4