

2001 STARTING SALARY SURVEY

So far, new chemistry graduates ride out the current recession in fairly good shape

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DESPITE THE SLOWDOWN IN THE rate of growth of the U.S. economy since mid-2000, the salaries and employment situation for newly graduated chemists held up reasonably well—albeit with some hints of incipient weakening—through the week of Oct. 8 last year. That is the date for which the American Chemical Society gathered data for its latest annual survey of new chemistry graduates.

For master's and Ph.D. graduates, median salaries were, respectively, 7% or 8% higher than they had been for the year-earlier graduating class. But salaries for bachelor's graduates showed a nominal 1% dip.

As for employment, the percentages of those unemployed but seeking employment remained unchanged and reasonably low at 3% for Ph.D. graduates and 5% for those with master's degrees. For those with bachelor's degrees, unemployment moved up from 4% to 6%. At all three degree levels, the percentages of those with full-time jobs were still quite high by historical standards but down somewhat from unusually strong year-earlier levels. This all meant that a slightly higher percentage of chemistry graduates went to graduate school or took postdoc positions in 2001 than they did in 2000.

The survey also confirms and quantifies some of the shifts in the chemical workforce that have been under way for some years. For instance, women now make up a clear majority of those passing the entry point for the chemical profession—the acquisition of a bachelor's degree in chemistry. And the profile of where the jobs are for chemists continues to move away from the traditional chemical manufacturing industry and toward pharmaceutical manufacturers and analytical and research laboratories.

The new survey is of people who graduated with chemistry degrees between July 2000 and June 2001. The results indicate that 40% of the new

bachelor's degree graduates, 55% of master's graduates, and 48% of Ph.D.s held full-time jobs—either permanent or temporary—as of last October. These levels were down from 44%, 62%, and 50%, respectively, for the previous graduating class as of October 2000.

The salary data for all chemists who responded to the latest survey reveal a similar pattern of strength with a hint of possible pending problems if the sluggishness in the economy persists.

The median salaries for master's and Ph.D. graduates show a continuation of the

solid growth of the past five years. For all master's graduates, the median moved up to \$48,000 from \$45,000 for the year-earlier survey of 1999–2000 graduates (C&EN, Sept. 3, 2001, page 48). For Ph.D. graduates, the gain was from \$65,000 to \$70,000. However, the median salary for bachelor's degree graduates dipped slightly to \$33,600 from \$34,000 a year earlier.

This overall picture of a relatively stable job situation for chemistry graduates is for a period that brought a sudden and sharp weakening of the overall labor market. After seven years of decline, unemployment among the civilian labor force surged from a 30-year low of 3.9% in October 2000 to 5.4% in October 2001.

The number of those unemployed ballooned by more than 2 million, from 5.53 million in October 2000, to a still-rising 7.67 million one year later. Over the same period, unemployment among the college educated almost doubled from just over 600,000, or 1.7%, to 1.13 million, or 3.0%.

STARTING SALARY SURVEY. The findings from the latest survey are based on 3,049 responses to 8,936 questionnaires sent by the ACS Department of Career Services to newly graduated chemists living in the U.S.

This yielded an overall response rate of 34%, with bachelor's degree graduates at 35%, master's at 24%, and Ph.D.s at 40%.

This response is below the traditional 45 to 50% rate for ACS's salary and employment surveys. But it is an improvement over the 27% return to the survey of 1999–2000 graduates. The 1999–2000 survey was handicapped by the late mailing of the questionnaire because of problems with the gathering of the addresses of the graduates from their departments by the ACS Committee on Professional Training. The mailings were more timely for the latest survey.

ACS's two long-standing annual salary surveys—of new graduates and of ACS members in the domestic workforce—are carried out under the general direction of the society's Committee on Economic & Professional Affairs. Since 1995, both have been conducted by Mary W. Jordan, senior analyst for the Department of Career Services. She also manages special ACS surveys. These include a study of older society members, in 2000, and of younger members, last year.

DEMOGRAPHICS

Women make up substantial majority of new bachelor's, nearly 40% of Ph.D.s

	BACHELOR'S	MASTER'S	PH.D.
GENDER			
Male	43.5%	52.6%	60.7%
Female	56.5	47.4	39.3
CITIZENSHIP			
U.S. native born	87.9%	65.3%	65.9%
Naturalized	7.5	5.6	3.5
Permanent resident	3.2	7.1	6.1
Temporary visa	1.4	22.0	24.6
RACE			
White	78.0%	64.9%	71.3%
Asian	11.8	21.6	22.3
Black	5.2	6.0	2.2
American Indian	0.7	1.5	0
Other	4.4	6.0	4.2
ETHNICITY			
Hispanic	3.1%	3.7%	3.7%

GRADUATION AGE

There is a seven-year gap between bachelor's and Ph.D.

	BACHELOR'S	MASTER'S	PH.D.
Median age	22	27	29
Mean age	24	29	31
Minimum age	16	21	22
Maximum age	75	73	57

NOTE: For 2001 graduating class.

DEMOGRAPHICS. Women make up

JOB MARKET

Weakening economy apparently did not greatly affect job prospects for new chemists last fall

	BACHELOR'S			MASTER'S			PH.D.		
	1999	2000	2001	1999	2000	2001	1999	2000	2001
Full-time permanent	36%	35%	31%	53%	56%	49%	43%	45%	45%
Full-time temporary	10	9	9	7	6	6	6	5	3
Graduate & professional school	44	46	47	31	27	33	—	—	—
Postdoctoral positions	—	—	—	—	—	—	46	41	44
Part-time permanent	1	1	1	0	1	2	0	0	0
Part-time temporary	3	2	3	2	3	4	1	1	1
Not employed but seeking employment	5	4	6	5	5	5	2	3	3
Not employed and not seeking employment	2	3	3	2	2	1	2	5	4

NOTE: Employment status of chemistry graduates as of October each year.

JOBS AND GENDER

Men and women chemists find similar opportunities after graduation

	BACHELOR'S			MASTER'S			PH.D.		
	MEN	WOMEN	TOTAL	MEN	WOMEN	TOTAL	MEN	WOMEN	TOTAL
Full-time permanent	32%	31%	31%	48%	51%	49%	48%	40%	45%
Full-time temporary	9	10	9	4	7	6	3	3	3
Graduate & professional school	49	45	47	37	29	33	—	—	—
Postdoctoral positions	—	—	—	—	—	—	42	48	45
Part-time permanent	1	1	1	1	2	2	0	1	0
Part-time temporary	2	3	3	4	3	4	1	2	1
Not employed but seeking employment	5	7	6	5	6	5	2	4	3
Not employed and not seeking employment	3	4	3	1	2	1	4	3	4

NATURE OF EMPLOYMENT

Profile of full-time jobs by type of employer does not vary significantly by gender

	BACHELOR'S			MASTER'S			PH.D.		
	MEN	WOMEN	TOTAL	MEN	WOMEN	TOTAL	MEN	WOMEN	TOTAL
Academia	22%	23%	23%	18%	19%	19%	25%	28%	26%
Business/industry	69	68	68	75	78	76	66	70	67
Government/other	8	8	8	7	3	5	9	1	6
Self-employed	1	1	1	0	0	0	0	1	1

NOTE: Percentages are of 2001 chemistry graduates with either permanent or temporary full-time jobs.

SALARIES AND EXPERIENCE

As would be expected, graduates with work experience have salary edge

	BACHELOR'S			MASTER'S			PH.D.		
	1999	2000	2001	1999	2000	2001	1999	2000	2001
Less than 12 months	\$30.0	\$33.5	\$32.2	\$42.0	\$44.1	\$43.0	\$61.0	\$64.5	\$69.5
12-36 months	32.5	34.0	36.0	44.1	42.0	49.1	55.5	64.0	63.0
More than 36 months	39.0	40.0	36.7	47.0	49.5	50.0	64.0	68.5	74.0
ALL	\$31.0	\$34.0	\$33.6	\$43.1	\$45.0	\$48.0	\$60.5	\$65.0	\$70.0

almost 57% of the 2000-01 class of new chemistry bachelor's graduates. This is up from 48% for the 1995-96 class. Over the same period, women's share of new chemistry doctoral degrees has moved up from 36% to 39%. For master's degree graduates, the increase is smaller, from 46% to 47%. Jordan points out that these estimates for women may be high by maybe a couple of percentage points because of the greater propensity of women to respond to surveys.

As the pipeline of women with chemical degrees is filled, the percentage of women in the chemical workforce has increased. An analysis of recent ACS surveys by gen-

SALARIES OF NEW GRADS

Starting earnings of new bachelor's and master's falter

	BACHELOR'S	MASTER'S	PH.D.
1991	\$23.0	\$32.0	\$46.0
1992	24.0	31.5	47.5
1993	24.0	34.0	50.4
1994	24.0	30.8	48.0
1995	25.0	36.0	50.0
1996	25.0	34.1	45.0
1997	28.0	37.5	54.0
1998	29.5	38.5	59.3
1999	30.0	42.0	61.0
2000	33.5	44.1	64.5
2001	32.2	43.0	69.5

NOTE: Median salaries, as of October of each year, of new graduates with full-time jobs and less than 12 months of technical work experience prior to graduation.

STARTING SALARIES

Apparent differences with gender are not readily explained

\$ THOUSANDS	BACHELOR'S	MASTER'S	PH.D.
Men	\$32.0	\$47.0	\$70.5
Women	32.5	39.0	67.5
ALL	32.2	44.0	69.3

NOTE: Median salaries as of week of Oct. 8, 2001, for graduates with full-time permanent employment and less than 12 months of technical work experience prior to graduation.

SALARIES BY EMPLOYER

Lure of high industry salaries is strong for chemistry Ph.D.s

\$ THOUSANDS	BACHELOR'S	MASTER'S	PH.D.
Academia	\$30.0	—	\$40.0
Business/industry	34.0	47.5	72.0
Government/other	30.1	—	—
ALL	32.1	44.0	69.8

NOTE: Median salaries as of week of Oct. 8, 2001, for graduates with full-time permanent employment and less than 12 months of technical work experience prior to graduation. Where no data are shown, sample set is too small (fewer than 15) to yield meaningful results.

Chemical Engineering Grads Retain Edge Over Chemists

The low response from new chemical engineering graduates to the latest survey—the return of 558 of 1,908 questionnaires mailed—precludes any extensive analysis of their salaries and job situation.

However, the return is large enough to confirm their overall status. As has long been the case, they are better paid than chemistry graduates, they are more likely to be employed full time, less likely to be in graduate school or on postdocs, and are more likely to be male.

The median salaries for chemical engineering graduates with less than one year of technical work experience prior to graduation are \$51,000 for those with a bachelor's degree, \$60,000 for those with a master's, and \$74,400 for Ph.D.s. These compare with the medians of \$32,200, \$43,000, and \$69,500, respectively, for chemistry graduates.

For chemical engineering bachelor's graduates, grade point average is important. Not so for chemists. The median salaries for chemical engineers ranges from \$46,500 for those with a C average to \$54,000 for those with an A. For chemists, salaries hover very close to \$32,000, regardless of grade point average.

der and age supports this trend. The recent survey of younger members—those under 40 years of age—showed 36% of respondents to be women (C&EN, Dec. 24, 2001, page 39). The latest survey of ACS members in the domestic workforce indicates that 24% are women (C&EN, Aug. 20, 2001, page 51). And the survey of older ACS members, those between 50 and 69 years of age, revealed only 12% to be women (C&EN, June 5, 2000, page 42).

A demographic that has not changed as much as many people within the chemical profession would like is the participation of underrepresented minorities: blacks, Hispanics, and American Indians.

Because of the small numbers involved, annual survey data on such minorities can be erratic from year to year. For instance, the 6% of new chemistry master's degree graduates responding to the latest survey who are black seemingly represents a significant jump from the 3% of the year-earlier class. On the other hand, the 3% of bachelor's degree graduates in the new survey who are Hispanic is sharply down from the year-earlier 6%.

Analysis of the numbers of minority graduates at all three degree levels that downplays such seemingly aberrant one-year peaks or troughs indicates that the percentages of chemistry graduates who are black continue to hover at about 5% of bachelor's, 3% or 4% of master's, and

3% of Ph.D.s. For Hispanics, it is most likely about 4% for all degrees. Participation of American Indians remains at less than 1% across the board.

Asians, about 4% of the U.S. population, remain remarkably well represented in chemistry graduating classes—if slightly less so than a few years ago. Comparing the class of 1996–97 with the class of 2000–01 shows reduction in the numbers who are Asian from 13% to 12% of bache-

lor's, from 31% to 22% of master's, and from 27% to 22% of Ph.D.s. These numbers are boosted, especially at the master's and Ph.D. levels, by students from abroad.

Of the chemical engineering bachelor's graduates responding to the survey, 77% had full-time jobs, and 14% were in professional or graduate school. This profile is very different from that of chemistry graduates: 40% with full-time jobs and 47% staying in school. At the Ph.D. level, the split is 72% of chemical engineers and 48% of chemists with full-time jobs, and 19% of chemical engineers and 44% of chemical engineers on postdocs.

Chemical engineering is also undergoing a gender transition. But it is trailing chemistry slightly. Of the 2000–01 class of chemical engineering bachelor's graduates, 47% were women. This compares with the 57% of chemistry graduates. At the master's level, 37% of chemical engineering graduates and 47% of chemistry graduates are women, as are 33% and 39%, respectively, of Ph.D. graduates.

By race and ethnicity, the 2000–01 graduating classes of chemical engineers and chemists were very similar, with about 4% black, 4% Hispanic, and less than 1% American Indian. Asians make up about 12% of both classes at the bachelor's level, and comfortably more than 20% of master's and Ph.D.s.

SALARIES. The overall pattern of the growth of the salaries of new chemistry graduates with full-time jobs over the past 10 years is unambiguous. From 1991 to 1996, gains were halting and slow, even after the boom started. Since then, they have been reasonably consistent and strong.

For instance, 2000–01 Ph.D. graduates with 12 months or less of technical work experience prior to graduation were paid \$69,500. This was 54% more than the \$45,000 received by their predecessors five years earlier—a 9% average annual growth rate. Growth for master's and bachelor's graduates has been less spectacular at about a 5% annual rate. Over the period, the Consumer Price Index was advancing at a 2% annual rate.

However, interpreting the median salaries—and especially year-to-year salary increases—for subsets of the population of new chemistry graduates with full-time jobs needs to be done with great care. For one thing, this is quite a heterogeneous group. Its members vary, for instance, by level of degree, by type of job, by type of employer, and by amount of previous work experience.

In fact, most of the salary data provided to the annual surveys of new

WHERE THE JOBS ARE

New graduates are more likely to find jobs with drugmakers and in analytical/research labs

% OF CHEMISTS AT ALL DEGREE LEVELS WITH FULL-TIME PERMANENT JOBS	2000-01 GRADUATES	ALL CHEMISTS IN 2001 WORKFORCE
MANUFACTURING		
Chemical and related	10%	19%
Pharmaceuticals and related	26	19
Other manufacturing	15	19
All manufacturing	51	57
ACADEMIA		
University/four-year college	9	17
Medical/professional school	4	2
Two-year college	1	2
Elementary/secondary school	5	2
Other	1	—
All academia	20	23
Analytical/research services	18	9
Government	7	8
Self-employed	1	1
Other	3	2

NOTE: Data for all chemists are from 2002 salary and employment survey of ACS members in the workforce.

PRIMARY WORK FUNCTION

Chemistry graduates in research and development are paid best

\$ THOUSANDS	BACHELOR'S	MASTER'S	PH.D.
Teaching	\$29.9	—	\$40.5
Management	31.0	—	—
Research	36.0	53.0	71.4
Development/design	35.0	52.5	72.0
Production/quality control	32.4	—	—
Professional services	34.0	—	—

NOTE: Median salaries as of week of Oct. 8, 2001.

graduates are not actually for starting salaries. Only 18% of Ph.D. graduates responding to this year's survey had started their current job on July 1, 2001, or later and were thus likely reporting a true starting salary. The percentages were higher for master's graduates, at 29%, and bachelor's, at 48%.

Furthermore, the data obtained from salary surveys are estimates. For instance, a reported median salary of, say, \$65,000, is really an indication that there is a 95% probability that the true median for the population being measured is \$65,000 \pm $x\%$. And the $x\%$ can typically be 3% or even more depending on, among other factors, the number of responses. This has the potential to wreak havoc on year-to-year salary changes deduced as the difference between medians obtained from separate surveys conducted one year apart.

However, the market for new graduates is inherently a volatile one, vulnerable to sharp changes. In a period of economic and financial stress, the slowing or halting of planned acquisition of new personnel can be done immediately and be less disruptive for an organization than firing experienced personnel. And a slump in demand for new chemists tends to quickly dampen the salaries they will receive.

Pregraduation work experience is, not unexpectedly, an important salary factor. The median salaries for bachelor's graduates with less than one year of such experience and with more than three years are \$32,200 and \$36,700, respectively. For master's graduates, the range is from \$43,000 to \$50,000. For Ph.D.s, it is from \$69,500 to \$74,000.

The data show gender equality in the median salaries of inexperienced bachelor's degree graduates with less than 12 months of technical experience prior to graduation: \$32,500 for women, \$32,000 for men. However, men have a persistent advantage among master's grad-

FURTHER STUDIES

Male graduates are more likely than females to continue full-time studies

% OF RESPONDENTS	FULL TIME	PART TIME	NONE
BACHELOR'S			
Men	49%	4%	47%
Women	45	6	49
ALL	47	5	48
MASTER'S			
Men	37%	7%	56%
Women	29	3	68
ALL	33	5	62

FIELD OF FURTHER STUDIES

Master's graduates are more likely than bachelor's to stick with chemistry

% OF RESPONDENTS	MEN	WOMEN	ALL
BACHELOR'S			
Chemistry	38%	35%	37%
Chemistry related	12	12	12
Medicine/dentistry	32	28	30
Pharmacology	4	8	7
Other	14	17	14
MASTER'S			
Chemistry	71%	68%	70%
Chemistry related	6	10	8
Medicine/dentistry	8	8	8
Pharmacology	0	3	1
Other	15	11	13

uates, \$47,000 compared with \$39,000, and Ph.D. graduates, \$70,500 compared with \$67,500.

The advantages for men at the higher degree levels are not readily explained away. They are likely real. For instance, there are only slightly more women Ph.D. graduates in lower paying academia: 28% compared with 25% of the men. And there appears to be no major differences in the distribution of jobs by gender and by work function. In fact, a higher percentage of women graduates, 37%, is in generally higher paying research jobs than are men, 32%. However, women are paid less in all other identified work functions.

FURTHER STUDY. Almost half, 47%, of

JOB SATISFACTION

New doctoral chemists are generally the most positive

\$ THOUSANDS	BACHELOR'S	MASTER'S	PH.D.
PERCENTAGE AGREEING THAT JOB IS			
commensurate with training	76%	81%	88%
challenging	76	83	91
related to field	78	87	92

EMPLOYMENT DATE

First-job salaries vary little by gender

MEDIAN SALARIES \$ THOUSANDS	START DATE OF CURRENT JOB	
	BEFORE JULY 1, 2001	JULY 1, 2001, AND LATER
BACHELOR'S		
Men	\$35.0 (54%)	\$33.0 (46%)
Women	34.8 (50)	32.0 (50)
ALL	35.0 (52)	32.5 (48)

MASTER'S

Men	\$52.0 (78%)	\$43.4 (22%)
Women	45.0 (64)	47.6 (36)
ALL	49.5 (71)	45.0 (29)

PH.D.

Men	\$71.0 (82%)	\$63.0 (18%)
Women	69.0 (87)	— (13)
ALL	70.0 (84)	66.3 (16)

NOTE: Percentages are those within the category. For instance, for men, 46% of 2001 bachelor's graduates, 22% of master's graduates, and 18% of Ph.D. graduates started in their current positions on July 1, 2001, or later. Salaries are as of week of Oct. 8, 2001.

bachelor's graduates responding to the survey indicate that they will continue with full-time studies. Men are slightly more likely to do so, 49%, than women, 45%. At the master's degree level, men have a large edge: 37% compared with 29%. Another 5% of both bachelor's and master's graduates will undertake part-time studies.

As to what they will study, for 49% of the bachelor's degree graduates, it will be chemistry or a chemistry-related field. For 30%, it will be medicine or dentistry, and for 7%, pharmacology.

Master's graduates, being further along in their studies, are more likely to stay with chemistry, 78%; only 8% take up medicine or dentistry, and 1%, pharmacology.

EMPLOYMENT. Comparing the breakdown of where new chemistry graduates find jobs with the employer profile of the entire ACS chemical workforce obtained from the latest salary and employment survey indicates three major differences: The percentage of new graduates finding work in the chemical industry, 10%, is far lower than the 19% of all chemists so employed. This trend is reversed for the pharmaceutical and bioproduct industry, which accounts for 26% of new graduates and 19% of all working chemists. And analytical/research laboratories have an increasing role in the job market, with 18% of new graduates and 9% of all working chemists. ■