SALARIES & JOBS: 2002

After sharp upward thrust, further salary and job gains for chemists are tested by uncertain economy

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THE GOOD NEWS FOR SCIENTISTS is that four major surveys of the salaries and employment status of chemists and other scientists published within the past 12 months all paint much the same encouraging picture: plenty of jobs, a lively employment market, low unemployment, and solid salary increases.

The not-so-good news is the increasingly questionable relevance of these surveys to what may be in store for chemists and other scientists in 2002.

Data for two of the surveys were gathered as the longest economic expansion in U.S. history built to a spectacular final surge in the middle of last year. The other two studies are based on data gathered during the subsequent jarringly sudden slowdown but, apparently, before the retreat had had time to have significant effect on the job market for scientists. Economic growth essentially ground to a halt by mid-2001. Since then, prospects have only gotten worse.

Two of the surveys are ACS's long-established annual surveys of the salaries and employment status of its members in the domestic workforce (C&EN, Aug. 20, page 51) and of new chemistry and chemical engineering graduates (C&EN, Sept. 3, page 48). The former, which reports data as of March 1, reveals an unemployment rate of 1.5%, the lowest in 10 years, and salary advances comfortably in excess of the rate of inflation.

The graduate survey, which covers chemists and chemical engineers at all degree levels who graduated between July 1999 and June 2000, also indicates a good job market and a fourth consecutive year of strong gains in the starting salaries of chemical professionals. Data for this survey were gathered during the first half of this year, but reflect the situation that held as of the week of Oct. 9, 2000.

The 2000 version of the American Institute of Physics (AIP) biennial survey of the members of its constituent societies shows an unemployment rate of less than 1% as of May 2000. It also reveals about a 7% increase in median salaries since the previous survey in 1998.

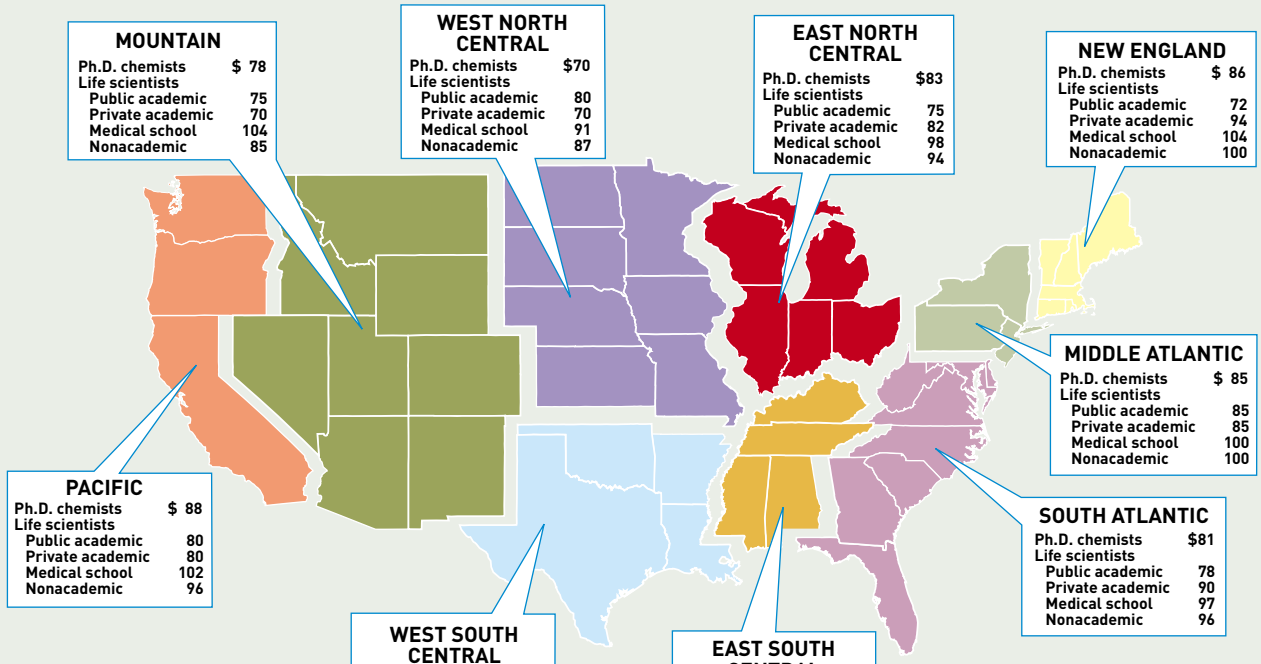
And an American Association for the Advancement of Science (AAAS) survey of its 70,000 members in the U.S. who are life scientists found a 1% unemployment rate. Based on a questionnaire mailed in June, this study also reveals a high level of job satisfaction and what is described as a good salary situation for most respondents [*Science,* **294,** 395 (2001)].

Comparisons of the data from these surveys indicate that, in terms of salary, chemists generally hold their own with physicists, but lag behind some life scientists, especially those who are physicians as well as scientists.

ALTHOUGH THE OVERALL outlook is gloomy, the timing and full extent of the impact of the slowing economy and of the events of Sept. 11 on the chemical job market are unknown at this time.

GEOGRAPHY

Medical school life scientists have a salary advantage in almost all areas



NOTE: Median salaries in thousands of dollars as of early 2001. **SOURCES:** ACS's 2001 annual salary and employment survey and 2001 survey of life sciences members of the American Association for the Advancement of Science

On the positive side, R&D funding by industry grew at an almost 9% annual rate between 1994 and 2000, and demand for chemists, especially in the pharmaceutical industry, has so far remained strong.

It should be noted that the fortunes of chemists have not always moved in lockstep with the economy. For instance, one of the worst years for chemists, as measured by both ACS surveys, was 1996. That year, the record-breaking 1992–2000 economic boom was well under way. But that was also the year in which starting salaries for Ph.D. graduates in chemistry were lower—even in current dollars—than they had been for 1990 graduates. Unemployment among ACS members was very close to its 30-year high.

This year is the opposite. According to the ACS surveys, it is the strongest year in more than a decade for chemists. Chemists have finally caught up with the boom in terms of salary gains, and jobs are relatively plentiful. But this apparent strength comes just as the boom has fizzled out and the economy is apparently poised to go over a cliff.

In the second quarter of last year, the gross domestic product grew at a 5.7% annual rate. In the four subsequent quarters, GDP drifted down to 1.3%, 1.9%, 1.3%, and 0.3%, respectively. Preliminary data for the third quarter of 2001 puts it into negative territory, with a 0.4% decline.

This slowdown has already had a considerable impact on the civilian labor force. In September of this year, 7 million Americans, 1.5 million more than a year earlier, were unemployed and seeking jobs. This sharp increase comes after eight consecutive years during which the number of unemployed dropped by an average of more than 500,000 annually. In October, the number of unemployed surged up by another 732,000.

The overall unemployment rate for the civilian labor force rose from 3.9%—a 30-year low—last September to 4.9% this September and 5.4% in October as the total number of Americans working dipped marginally. The last such year-to-year decline occurred in 1991. From 1992 through 2000, the number of Americans with jobs grew by an average of 2 million per year to 135 million from 119 million.

For those with a college degree, the jobless rate rose to 2.5% from 1.9% between September 2000 and September 2001. For those with a managerial or professional specialty, it went to 2.4% from 1.8%.

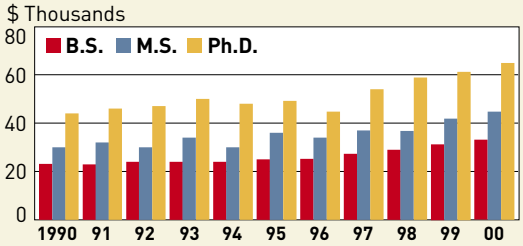
Another negative indicator is the growing number of what the Bureau of Labor Statistics describes as "layoff events." These were up to 3,679 in the first half of this year from 2,601 in the first half of 2000.

FOR CHEMISTS, the basic salary numbers from this year's survey of ACS members in the domestic workforce show a median salary of $73,000 for all respondents, with bachelor's-degree holders at $55,000, master's-degree holders at $65,000, and those with doctorates at $82,200. These medians are of the base pay from respondents' primary jobs. A median is the value that is equaled or exceeded by one-half of the respondents.

For men, the median is $77,000; for women, $60,000. However, this apparent 28% advantage for men is, to a substantial extent, age-related. Men, on average, are seven years older and are more likely to hold a Ph.D. degree. Of male industrial chemists, 58% have doctorates, compared with 35% of women. However, although women chemists today might, in a statistical sense, earn near-equal pay for equal

STARTING OUT

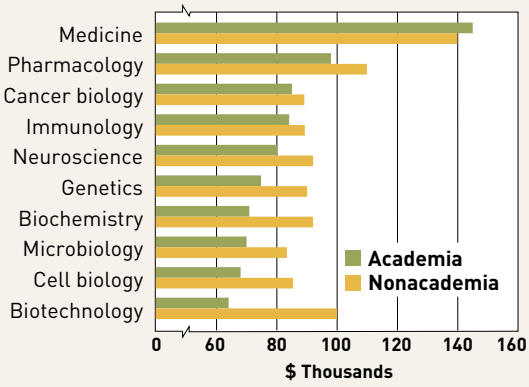
Chemists' salaries have spurted since pausing in the mid-1990s



NOTE: Median salaries of graduates with full-time employment and less than one year of technical work experience prior to graduation.
SOURCE: ACS's annual starting salary surveys

LIFE SCIENTISTS

Salary medians vary by field and place of work



SOURCE: 2001 survey of life sciences members of the American Association for the Advancement of Science

Aging

Median age of chemical workforce has risen by four years in past decade

	MEAN AGE				MEDIAN AGE			
	1990	1995	2000	2001	1990	1995	2000	2001
ALL CHEMISTS	41.3	43.3	44.8	44.7	41	42	45	45
BY GENDER								
Male	42.6	44.6	46.3	46.3	42	44	46	47
Female	36.3	38.7	40.4	40.8	35	37	39	40
BY DEGREE								
B.S.	37.5	39.3	40.9	40.7	35	38	41	41
M.S.	41.2	43.3	44.6	44.5	41	43	45	45
Ph.D.	42.9	45.0	46.2	46.2	43	45	46	46
BY EMPLOYER								
Industry	39.9	42.1	43.3	43.2	39	41	43	43
Government	42.1	45.0	47.1	48.1	40	45	48	49
Academia	44.2	44.9	46.9	48.0	46	45	47	49
BY RACE/ETHNICITY								
White	41.6	43.7	45.2	45.3	41	43	45	46
Asian	40.0	41.3	42.5	42.6	40	39	41	40
Black	39.1	41.5	42.8	44.7	39	40	43	45
American Indian	39.9	41.9	43.7	42.0	39	43	42	44
Hispanic	38.5	39.9	41.9	42.1	37	38	41	41

SOURCE: ACS's 2001 salary and employment survey

work, they are still heavily underrepresented in the higher paying aspects of the chemical profession, such as management, and overrepresented in the lower paying ones, such as chemical education.

Industrial chemists retain a considerable edge with a median salary of $78,000, compared with $73,000 for government chemists. For academic chemists, the median is $60,000, a figure depressed by the relatively poor salaries of those on the lower rungs of academia. Salaries for full professors are reasonably competitive with those of chemists with more senior positions in industry and government.

For all respondents as a group, the gain in median salary over 2000 is 4.3%, outpacing the 2.7% increase in the cost of living. For chemists as individuals, the median salary increase is between 5 and 7%, depending on how it is calculated. Chemists' personal salary increases are always higher than the increases for chemists as a group, because the individual gains fully account for increases due to advancing age, growing experience and responsibility, and promotions. These data are obtained from responses to a question asking salary as of both March 1 of the current year and March 1 of the previous year.

Overall year-to-year salary growth for a population as large and stable as the chemical profession as a whole largely reflects the rate of inflation plus the effect of any demographic shifts. One such shift is the four-year increase in the median age of chemists over the past decade, to 45 from 41.

The overall employment situation for chemists revealed by this year's ACS survey was the strongest since 1990. Only 5.4% of respondents did not have full-time jobs. This was down from 8.9% as recently as 1995. Since then, the number of people in postdoctoral positions or fellowships has tumbled to an all-time low of 1.4% this

Median salary gains

2000–01 increases for chemists as individuals are in 4 to 8% range

SALARY INCREASE, 2000–2001	MEDIAN SALARY INCREASES				MEAN SALARY INCREASES			
	B.S.	M.S.	PH.D.	TOTAL	B.S.	M.S.	PH.D.	TOTAL
ALL CHEMISTS	5.0%	4.9%	4.8%	4.9%	7.5%	6.8%	6.6%	6.9%
BY EMPLOYMENT								
Industry	5.3	5.0	5.1	5.1	7.8	6.8	7.3	7.4
Government	4.3	4.3	4.3	4.3	6.1	7.6	6.7	6.7
Academia	5.1	4.4	4.2	4.3	6.8	6.5	5.6	5.8
BY AGE								
20–29	8.2	8.0	5.5	7.7	11.6	8.5	8.5	10.5
30–39	5.9	6.2	6.0	6.0	8.5	8.6	8.1	8.3
40–49	4.5	4.5	5.0	4.8	6.2	6.2	6.9	6.6
50–59	4.2	4.3	4.2	4.2	5.3	5.8	5.5	5.5
60–69	3.9	4.2	4.0	4.0	4.4	5.4	5.0	5.0

NOTE: Salary increase between March 1, 2000, and March 1, 2001, for individual chemists employed full time by the same employer over the period. **SOURCE:** ACS's 2001 salary and employment survey

Salaries

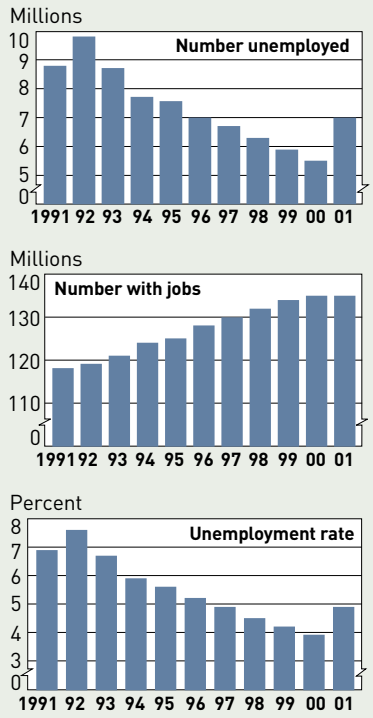
Gains for chemists in groups consistently exceed rate of inflation

$ THOUSANDS	1991	1996	2000	2001	AVERAGE ANNUAL INCREASE 2000–2001	1996–2001	1991–2001
ALL CHEMISTS	$52.0	$60.0	$70.0	$73.0	4.3%	4.1%	3.4%
BY GENDER							
Men	54.0	63.0	74.1	77.7	4.3	4.1	3.4
Women	40.7	45.7	56.0	60.0	7.1	7.8	3.9
BY HIGHEST DEGREE							
Bachelor's	40.3	45.0	53.1	55.0	3.6	4.1	3.2
Master's	47.4	53.6	62.0	65.0	4.8	3.9	3.2
Ph.D.	58.0	68.0	79.0	82.2	4.1	3.8	3.5
BY EMPLOYER							
Industry	54.0	62.9	74.5	78.0	4.7	4.4	3.7
Government	50.0	58.9	70.0	73.0	4.3	4.4	3.9
Academia	46.0	50.0	58.0	60.0	3.4	3.7	2.7
BY DEGREE/EMPLOYER							
Bachelor's							
Industry	41.7	45.0	54.2	56.1	3.4	4.5	3.0
Government	39.0	44.8	53.7	53.8	0.2	3.7	3.3
Master's							
Industry	50.0	56.9	65.5	68.0	3.8	3.6	3.1
Government	45.7	52.0	61.5	65.0	5.7	4.6	3.6
Ph.D.							
Industry	63.0	75.0	86.2	90.2	4.6	3.8	3.7
Government	56.6	68.4	80.0	84.8	6.0	4.4	4.1
Academia	47.6	52.5	60.0	63.0	5.0	3.7	2.8
Increase in consumer price index					2.9	2.5	2.7

SOURCE: ACS's annual salary and employment surveys

OVERALL ECONOMY

Changes for civilian labor force over past year were dramatic



NOTE: All data are seasonally adjusted and as of September each year.
SOURCE: Bureau of Labor Statistics

At work

2001 employment situation is the best in a decade for chemists

EMPLOYMENT STATUS[a]	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Employed full time	94.0%	93.4%	92.8%	91.9%	91.1%	91.5%	93.5%	92.9%	92.9%	92.9%	94.6%
Employed part time	1.8	2.2	2.2	2.5	2.7	2.7	2.1	2.5	2.7	3.0	2.5
Postdoctoral or fellowship	2.6	2.4	3.0	2.9	3.6	2.8	2.3	2.3	2.1	2.1	1.4
Unemployed	1.6	1.9	2.0	2.7	2.6	3.0	2.0	2.3	2.3	2.0	1.5

a As of March 1, 2001. Based on population that excludes those unemployed but not seeking employment. **SOURCE:** ACS's 2001 salary and employment survey

year, from 3.6%, as the job market opened up. Those with part-time jobs dropped a little, to 2.5% from 2.7%, while those unemployed but seeking employment fell to 1.5% from 2.6%, with an intermediate high of 3.0% in 1996.

Growth in starting salaries of chemistry graduates has shown a bifurcated pattern over the past decade. According to the ACS surveys, they grew irregularly and slowly between 1990 and 1996, but very quickly since then. In the first period, the median salaries paid for new chemistry graduates grew at an average annual rate of 1.4% for bachelor's-degree holders, 2.2% for master's-degree holders, and 0.4% for people with doctorates.

For the 1996 to 2000 period, these rates spurted to 7.6%, 6.6%, and 9.4%, respectively. Over the full 10 years, the growth rate was just under 4% per year for all three degree levels. For 2000 graduates, the gains over the salaries paid to 1999 graduates were 11.7% for chemists with bachelor's degrees, 5.0% for those with master's degrees, and 5.7% for doctorates.

The median starting salaries for all chemistry graduates who received their degrees between July 1999 and June 2000 were $34,000 for bachelor's degrees, $45,000 for master's degrees, and $65,000 for doctorates. Starting salaries for chemical engineering graduates were, as usual, higher, with bachelor's at $50,000, master's at $56,700, and doctorates at $72,000.

In recent years, both ACS surveys have been conducted by Mary W. Jordan, senior analyst for the society's Department of Career Services.

The member survey was based on 9,800 responses to a questionnaire sent to a random sample of 22,400 of the society's approximately 100,000 domestic members who are less than 70 years old and not characterized as emeritus, retired, or student members. The starting salary survey was based on 3,500 responses to questionnaires sent to about 13,000 new graduates.

FOR THE 2000 AIP study, questionnaires were mailed to 15,200 nonstudent members of the institute's member societies residing in the U.S. They represented a random sample of about one-sixth of the target population. Responses from 9,350 members represented a very respectable 62% response rate.

Comparisons of salary data from this survey and from the closely comparable 2000 ACS member survey are not precise because of differences in methodology. However, they suggest near equality for chemists and physicists. The median salaries for Ph.D.s are $79,000 for chemists and $78,000 for physicists. At the master's level, it is $62,000 for chemists and $63,000 for physicists, while the relatively few bachelor's-degree physicists do have an edge over bachelor's-degree chemists at $60,000 compared with $53,100.

Similarly, the median salaries of doctoral chemists and physicists track reasonably closely with age. For all doctoral respondents to the two surveys, chemists may have a slight advantage in the earlier career years and physicists in the later years. For physicists, the range is from $59,900 for those zero to four years beyond their Ph.D. degree to $96,500 for those 24 to 29 years beyond. The ACS data for chemists are based on years since the bachelor's degree. Therefore, for doctoral chemists, the closest comparisons are median salaries of $63,600 for those five to nine years beyond their bachelor's degree and $90,000 for those 30 to 34 years beyond their bachelor's degree.

THE AAAS SURVEY OF the salaries and other employment-related parameters of its 70,000 domestic members who are life scientists represents the association's first venture into such surveying.

It is based on 8,692 responses, including 3,556 filed electronically, to a questionnaire sent to a random sample of 19,000 of the target population. The response rate was 46%. Respondents were mostly male, well established, academic, and older. Ninety-three percent had a Ph.D., an M.D., or both. Only 15% were under 40.

Continued on page 63

Academic salaries

Physicists may have a slight edge over chemists

$ THOUSANDS	PHYSICS	CHEMISTRY: NON-PH.D. SCHOOL	CHEMISTRY: PH.D. SCHOOL
Professor			
9- to 10-month salary	$81.0	$63.1	$85.1
11- to 12-month salary	108.0	95.0	106.1
Associate professor			
9- to 10- month salary	60.0	48.4	56.0
11- to 12-month salary	80.0	70.0	66.2
Associate professor			
9- to 10-month salary	49.0	40.0	49.2
11- to 12-month salary	58.3	50.5	56.8

SOURCES: ACS's 2000 salary and employment survey, 2000 American Institute of Physics member salary survey

Physicists/chemists

Salaries of Ph.D.s are in the same ballpark

$ THOUSANDS

PHYSICISTS: YEARS SINCE PH.D. DEGREE	ALL	INDUSTRIAL	PH.D. CHEMISTS: YEARS SINCE B.S. DEGREE	ALL	INDUSTRIAL
0 to 4	$59.9	$74.0	5 to 9	$63.6	$69.0
5 to 9	62.0	78.0	10 to 14	66.4	73.6
10 to 14	72.6	88.0	15 to 19	74.0	81.0
15 to 19	85.0	96.0	20 to 24	82.3	90.0
20 to 24	93.4	100.0	25 to 29	88.8	97.0
25 to 29	96.5	100.0	30 to 34	90.0	100.0

SOURCES: ACS's 2000 salary and employment survey, 2000 American Institute of Physics member salary survey

SALARIES

Continued from page 50

Those whose primary field is medicine enjoy the highest median salaries—$145,000 for those in academia and $140,000 for those who are not. For those in biotech, the median for academics is $63,000; for nonacademics, $100,000. Biochemists have medians of $71,000 for academics and $92,000 for nonacademics. For microbiologists, the medians are $70,000 for academics and $83,000 for nonacademics; for cell biologists, the corresponding numbers are $68,000 and $85,000.

ALL OF THESE FINDINGS compare fairly favorably with the median salaries of $63,000 for academic chemistry Ph.D.s and about $88,000 for nonacademic Ph.D.s obtained from the 2001 ACS member survey.

The analyses of salary by geographic region show the same profile for both the AAAS and ACS surveys. In both cases, pay tends to be higher on the Pacific and Atlantic coasts. With one exception, chemists' salaries more or less hold their own with those of life scientists. The exception is the clear salary advantage for life scientists who work in medical schools—and therefore are more likely to have an M.D.

Data obtained by a survey of the readers of *The Scientist,* a news biweekly for the life sciences, indicate generally lower salaries than those indicated by the AAAS survey. This is probably because readers of the publication are generally younger and less well qualified than those who responded to AAAS.

The Scientist poll (Sept. 17, page 30) gives a snapshot of the salaries of life scientists earlier this year. It does not give information on either salary increases or employment status. It was conducted by Abbott, Langer & Associates, an Illinois firm that specializes in salary surveys. It involved the publication in e-mailing invitations to participate to almost 24,000 print subscribers and to just over 27,000 registrants on its website. Responses totaled 7,902.

The three best-paying disciplines were bioengineering, clinical research, and bioinformatics, with medians for "salary plus cash compensation" of $77,000, $75,500, and $75,000, respectively.

Like the AAAS survey, *The Scientist* reveals that nonacademics earn more than academics, and that M.D. scientists earn more than Ph.D. scientists. ■