CLASS OF 2004 STARTING SALARIES

Constant-dollar pay of new chemists remains depressed; little change in soft job situation

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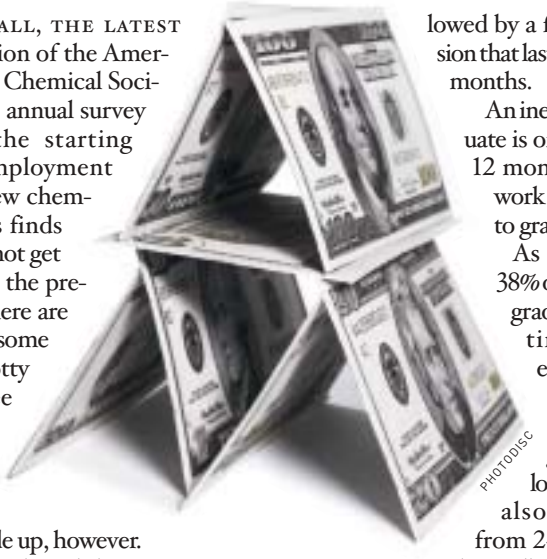
PHOTODISC

OVERALL, THE LATEST version of the American Chemical Society's annual survey of the starting salaries and employment situation for new chemistry graduates finds that things did not get any worse since the previous survey. There are even inklings of some modest and spotty gains after three tough years for the chemical profession. A lot of ground needs to be made up, however.

The survey gathered data as of the week of Oct. 4, 2004, from chemists who graduated between July 2003 and June 2004.

It reveals a median salary for inexperienced bachelor's degree graduates with full-time permanent jobs of $32,500. This median was up from the $32,000 posted by 2002–03 graduates a year earlier. The corresponding year-to-year gain for inexperienced Ph.D. graduates was to $65,000 from $63,300. For graduates with master's degrees, there was a slight dip to $43,600 from $44,500.

In constant-dollar terms, however, median salaries for inexperienced new chemistry graduates remained depressed. When adjusted for inflation, the median salaries for 2003–04 graduates at all three degree levels were about 10% below the salaries received by chemists who had graduated three or four years earlier. The longest and strongest economic expansion in U.S. history started to plateau about then, in 2000, and finally petered out in early 2001, to be followed by a fairly mild recession that lasted for about nine months.

An inexperienced graduate is one with less than 12 months of technical work experience prior to graduation.

As to employment, 38% of 2003–04 Ph.D. graduates found full-time permanent employment, up from 37% one year earlier. The gain for bachelor's graduates was also a nominal 1%—from 24% to 25%. For the smaller and more volatile master's class, the gain was bigger, from 41% to 48%.

In 2000, the last really healthy employment year for chemists, a considerably higher 45% of Ph.D. graduates, 35% of bachelor's, and 56% of master's reported that they had full-time permanent jobs upon graduation.

This year's survey was conducted by research associate Janel Kasper-Wolfe of ACS's Office of Member Information under the general guidance of the ACS Committee on Economic & Professional Affairs (CEPA). This committee also has ACS's annual survey of the salaries and employment situation of its members in the domestic workforce under its wing (Aug. 16, 2004, page 26).

THIS REPORT for C&EN is based on responses to questionnaires sent to 11,477 new graduates in chemistry or chemical engineering. Of these, 588 addresses were incorrect, leaving an effective mailing of 10,889. To date, almost 3,900 responses have been received, for a respectable response rate of 35%. Almost 3,400 of the responses were from chemists, representing a sample of about 25% of all chemistry graduates for the year. The other 500 responses were from chemical engineers.

Most of the chemists polled were graduates from schools with undergraduate chemistry programs approved by ACS's Committee on Professional Training. The smaller sample of chemical engineers consisted of graduates of departments accredited by the American Institute of Chemical Engineers and the Accreditation Board for Engineering & Technology.

The official report on this year's survey will be published this summer by the Office of Member Information. It will include the input from responses triggered by a final mailing urging nonrespondents to respond. Additional responses are unlikely to produce significant changes in the results.

As has long been the case, women graduates were more responsive to the latest survey than were their male colleagues. Of the total population sent the questionnaire, 46% were women and 54% were men. However, 54% of the responses were from women, 46% from men. This anomaly does not have a major impact on overall results of the survey, as the parameters measured are largely gender neutral.

The data on those to whom questionnaires were sent present the true gender breakdown of chemistry graduates. The schools that provided the names and addresses for the mailing also identified the gender of each graduate.

More specifically, 50% of the bachelor's chemists to whom the survey was sent were women. They provided 58% of the responses. At the master's level, the 48% who were women provided

SALARIES OF NEW CHEMISTRY GRADS

In constant dollars, pay has dipped over the past five years

	B.A./B.S.		M.S.		PH.D.	
$ THOUSANDS	CURRENT[a]	CONSTANT[b]	CURRENT[a]	CONSTANT[b]	CURRENT[a]	CONSTANT[b]
1994	$24.0	$30.6	$30.8	$39.3	$48.0	$61.1
1995	25.0	31.0	36.0	44.6	50.0	62.0
1996	25.0	30.1	34.1	41.1	45.0	54.2
1997	28.0	33.0	37.5	44.1	54.0	63.6
1998	29.5	34.2	38.5	44.6	59.3	68.7
1999	30.0	34.0	42.0	47.6	61.0	69.2
2000	33.5	36.7	41.1	45.1	64.5	70.8
2001	32.2	34.3	43.0	45.9	69.5	74.1
2002	31.0	32.5	45.0	47.2	67.5	70.9
2003	32.0	32.9	44.5	45.7	63.3	65.0
2004	32.5	32.5	43.6	43.6	65.0	65.0

NOTE: Median annual salaries as of early October of each year for new graduates with full-time permanent employment and less than 12 months of technical work experience prior to graduation. **a** For referenced year. **b** 2004 dollars.

JOB MARKET

No major changes in the job market for chemistry graduates occurred in 2004

EMPLOYMENT STATUS	BACHELOR'S					MASTER'S					PH.D.				
	2000	2001	2002	2003	2004	2000	2001	2002	2003	2004	2000	2001	2002	2003	2004
Full time															
Permanent	35%	31%	26%	24%	25%	56%	49%	38%	41%	48%	45%	45%	45%	37%	38%
Temporary	9	9	10	9	10	6	6	5	6	5	5	3	6	5	2
Part time															
Permanent	1	1	1	2	1	1	2	1	2	2	0	0	0	1	0
Temporary	2	3	6	6	4	3	4	2	5	4	1	1	2	2	1
Graduate/ professional school	46	47	47	49	49	27	33	47	33	32	—	—	—	—	—
Postdoctoral	—	—	—	—	—	—	—	—	—	—	41	44	40	51	52
Not employed															
Seeking	4	6	6	7	7	5	5	5	10	7	3	3	5	4	5
Not seeking	3	3	5	3	4	2	1	3	3	4	5	4	3	1	3

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

DEMOGRAPHICS

Foreigners, many Asian, retain major share of master's and Ph.D. classes

	B.A./B.S.	M.S.	PH.D.
CITIZENSHIP			
U.S. native born	89.3%	65.0%	62.5%
Naturalized	6.2	6.1	4.6
Permanent resident	2.9	6.4	3.9
Temporary visa	1.6	22.4	29.0
RACE			
White	80.2	66.9	70.7
Asian	9.8	24.0	24.5
Black	5.2	4.7	2.5
American Indian	0.9	0.3	0.5
Other	4.0	4.1	1.8
ETHNICITY			
Hispanic	4.3	5.0	1.8

54% of responses. For Ph.D.s, it was 33% and 40%, respectively.

There are some differences in the distribution of male and female graduates among the subdisciplines of chemistry. At the Ph.D. level, 77% of males earned their degrees in the classic disciplines: analytical, inorganic, organic, and physical. This compares with 65% of women. Women were more likely to receive their degrees in biochemistry, 18%, than were men, 10%.

Analysis of this year's responses brings out the continuing strong role of Asians, especially foreign-born, in chemistry in the U.S. All Asians combined accounted for 10% of the bachelor's graduates, 24% of the master's, and 25% of Ph.D.s.

Of respondents who were born in the U.S., 4.5% identified themselves as Asian. This number is in line with the about 4% of the U.S. population that is of Asian ancestry. However, Asians represented 52% of graduates who are naturalized citizens, 41% of those with permanent resident visas, and 66% of those on temporary visas.

The median age of 2004 bachelor's graduates was 23. For master's, it was 27, and for Ph.D.s, 30.

As would be expected, technical work experience prior to graduation has a significant impact on the salaries of new graduates. For instance, the $40,000 median salary of bachelor's graduates with more than 36 months of work experience exceeded the median of $32,500 for inexperienced graduates by 23%. For master's, the corresponding gap was 19%; for Ph.D.s, it was 9%.

The second major determinant of the starting salaries of chemistry graduates is the demand for their services.

Demand was weak in the early and middle '90s. Chemists in general had a particularly bad time in 1996 with a then near-record high rate of unemployment among ACS members. The median salary for Ph.D. graduates dropped that year, in current dollars, to $45,000 from $50,000 the previous year.

With demand then picking up as chemists started to benefit from the continuing economic expansion, the median salary of Ph.D. graduates soared to $69,500 by 2001. Since then, waning demand has helped drop this back to the $65,000 for the latest survey. In constant 2004 dollars, this decline from 2001 is from $74,100 to $65,000.

A third major determinant of financial rewards for graduates is where they work—

FIELD OF DEGREES

Relatively more males than females graduate in classic subdisciplines

	B.A./B.S.			M.S.			PH.D.		
	MEN	WOMEN	TOTAL	MEN	WOMEN	TOTAL	MEN	WOMEN	TOTAL
General chemistry	63.7%	61.4%	62.4%	20.9%	24.5%	22.8%	3.8%	6.7%	5.0%
Classic chemistry	4.3	2.1	3.2	56.4	47.3	51.5	76.7	65.4	72.1
Analytical	0.9	0.9	0.9	13.3	17.0	15.3	19.8	23.5	21.3
Inorganic	0.6	0.3	0.5	10.8	7.4	9.0	14.1	16.2	15.0
Organic	1.9	1.0	1.4	21.5	17.0	19.1	30.2	17.3	24.9
Physical	0.9	0.1	0.4	10.8	5.9	8.1	12.6	8.4	10.9
Biochemistry	25.0	29.0	27.3	7.0	12.8	10.1	9.9	17.9	13.2
Medical/pharmaceutical	0.5	0.5	0.5	1.9	4.3	3.2	2.3	2.8	2.5
Chemical education	3.8	4.6	4.3	6.5	5.3	5.8	0.8	1.1	0.9
Other chemistry	2.0	1.8	1.7	5.1	4.9	4.9	6.5	6.4	6.4

AGE AT GRADUATION

Median time from bachelor's to Ph.D. is seven years; to master's, four years

AGE AT GRADUATION	B.A./B.S.		M.S.		PH.D.	
	INEXPERIENCED	ALL	INEXPERIENCED	ALL	INEXPERIENCED	ALL
Median	23	23	26	27	29	30
Mean	23	24	27	30	30	31
Minimum	20	19	22	22	26	25
Maximum	51	83	73	73	77	77

CHEMICAL ENGINEERING GRADUATES

Chemical Engineers Maintain Broad-Based Salary Edge

The long-established salary advantage that chemical engineering graduates enjoy over chemistry graduates is pervasive. It is not due only to the higher percentage of chemical engineering graduates who find higher paying jobs in industry.

At the bachelor's level, 58% of 2003–04 inexperienced chemical engineering graduates with a full-time permanent job were employed in the manufacturing sector. This compares with 40% of working chemistry graduates. Conversely, only 6% of working chemical engineering graduates, compared with 22% of chemistry graduates, had jobs in the lower paying academic sector.

In addition, chemical engineering graduates had a clear salary advantage within each sector. The median salary for bachelor's chemical engineering graduates with jobs in manufacturing was $54,000. This was far higher than the $35,000 median for chemistry graduates. For those with jobs in academia, the medians were $50,300 and $30,900, respectively.

These differentials are somewhat smaller for Ph.D.s. For instance, the median salary of $74,800 for inexperienced chemistry graduates with manufacturing jobs was in the same ballpark as the $78,800 median for chemical engineering graduates.

Another difference between chemical engineering and chemistry graduates is in the numbers that continue with formal education. Of 2003–04 bachelor's chemistry graduates, it was 49%. Of bachelor's chemical engineers, it was 23%. Similarly, 52% of Ph.D. chemistry 2003–04 graduates took postdocs, while only 25% of chemical engineering graduates did so.

especially whether they work in academia or not.

Academia continues to be notoriously ungenerous to those entering its ranks. In the latest survey, the median salary of all Ph.D. graduates staying in academia was $43,500. For those taking jobs in chemical and related industries, it was $75,000. For those with jobs in the pharmaceutical field, it was $79,000, and for those working in nonindustry, nonacademic jobs, it was $70,000.

In industry, the size of the employer is apparently important. For bachelor's graduates, the salary range is from a median of $30,000 for employers with up to 99 employees to $41,000 for large employers with 25,000 or more employees.

Three factors that seemingly have less impact on the starting salaries of inexperienced chemistry bachelor's graduates are title of the degree, whether the degree is certified by ACS or not, and grade-point average.

THE MEDIAN of $32,400 for bachelor of science chemistry graduates was not significantly different from the $33,000 for those awarded a bachelor of arts degree. The median for certified graduates, $34,000, is not greatly larger than the $32,500 for noncertified graduates. Grade-point average does not have much impact, either. It ranges between medians of $34,100 for those with an A to $32,000 for those with a C.

There is no simple way to quantify with a single measure the overall employment situation for graduates who have earned their degrees within the previous few months. First, these graduates are in a transition period in their careers. And second, the option of graduate school or a postdoc reduces the numbers who might otherwise be out of work.

Over the past four years, however, the trends have been in the wrong direction. Between 2000 and 2004, the percentage of bachelor's graduates with full-time permanent jobs drifted down from 35% to 25%. For master's, the dip is from 56% to 48%; and for Ph.D.s, from 45% to 38%. The share of those unemployed but seeking employment has risen from 4% to 7% for bachelor's, from 5% to 7% for master's, and from 3% to 5% for Ph.D.s. For Ph.D.s, the percentage of those on postdocs has risen sharply from 41% to 52%. In 2004, 51% of those who took postdocs did so because they could not find suitable jobs. This number was up from 43% of the 2003 class.

This softness mirrors what has to date been a largely jobless recovery nationally

STARTING SALARIES

Chemical engineers retain huge starting salary advantage at bachelor's level

MEDIAN SALARY, $ THOUSANDS	B.A./B.S.	M.S.	PH.D.
Chemists	$32.5	$43.6	$65.0
Chemical engineers	52.0	59.0	78.6

NOTE: Median salaries, as of the week of Oct. 4, 2004, of 2003–04 graduates with permanent full-time jobs and less than 12 months of technical work experience prior to graduation.

SALARIES BY EXPERIENCE

Earlier work experience brings expected boost to salaries upon graduation

	BA./B.S.			M.S.			PH.D.		
$ THOUSANDS	2002	2003	2004	2002	2003	2004	2002	2003	2004
Less than 12 months	$31.0	$32.0	$32.5	$45.0	$44.5	$43.6	$67.5	$63.3	$65.0
12–36 months	34.1	35.0	35.0	41.0	45.0	43.8	65.0	72.5	62.3
More than 36 months	40.0	39.0	40.0	55.0	54.0	52.0	70.0	77.5	71.0
ALL	$32.8	$33.0	$33.5	$50.0	$48.0	$45.0	$68.0	$68.5	$65.0

NOTE: Median salaries of new graduates with full-time permanent employment as of early October each year.

SALARIES BY GENDER

Results are somewhat uneven, but may hint at small advantage for men

	B.A./B.S.			M.S.			PH.D.		
$ THOUSANDS	MEN	WOMEN	TOTAL	MEN	WOMEN	TOTAL	MEN	WOMEN	TOTAL
Academia	$32.0	$30.0	$31.0	$41.0	$40.0	$40.0	$45.0	$43.4	$43.5
Manufacturing	38.0	38.2	38.0	52.0	49.9	50.0	75.0	75.0	75.0
Nonmanufacturing	32.0	30.0	30.7	—	—	45.0	76.0	—	72.5
Government/other	36.7	34.2	34.2	—	—	—	—	—	—

NOTE: Median annual salaries of graduates with full-time permanent jobs as of the week of Oct. 4, 2004.
— = insufficient data.

BACHELOR'S SALARIES

Pay does not vary greatly with type of degree, certification, or grade-point average ...

	$ THOUSANDS
BY DEGREE	
B.S.	$32.4
B.A.	33.0
BY CERTIFICATION	
ACS certified	34.0
Not ACS certified	32.5
BY GRADE-POINT AVERAGE	
A	34.1
A–	33.0
B	32.4
C	32.0

... but size of employer is significant

NUMBER OF EMPLOYEES[a]	$ THOUSANDS
Fewer than 50	$30.0
50 to 99	30.0
100 to 499	32.0
500 to 2,499	34.0
2,500 to 9,999	35.0
10,000 to 24,999	37.3
25,000 or more	41.0

NOTE: Median salaries as of the week of Oct. 4, 2004, of 2003–04 bachelor's graduates with full-time permanent jobs and less than one year of technical work experience prior to graduation.
a Industrial/business employers only.

from the 2001 recession. This March, according to the Bureau of Labor Statistics (BLS), total private employment was still 468,000 lower than it had been four years earlier in February 2001, when it was at its all-time high of 111.6 million.

The situation is much the same for BLS's monthly count of people on nonfarm payrolls. This March's level of 132.9 million was only 380,000 higher than it had been when it, too, peaked in February 2001.

This paltry four-year gain compares adversely with the way payrolls have recovered from earlier downturns and then moved aggressively into new high ground. Payrolls grew by 4.3 million in the four years following the previous peak of 109.8 million in June 1990. And the four years after the peak, prior to that of 91.5 million in August 1981, witnessed the addition of 6.3 million payroll jobs.

The question for chemists and all others in the workforce today is, Are the about 5 million payroll jobs that would have been generated since early 2001 if the previous recovery profile had been followed—but wasn't—a passing aberration? Or are they indicative of profound and unhealthy changes in the employment market?

Where 2004 graduates

BACHELOR'S SALARIES BY JOB FUNCTION

Management does not pay well for new graduates

$ THOUSANDS	MEN	WOMEN	TOTAL
Development & design	$36.5	$39.0	$38.0
Teaching	34.2	36.6	35.0
Professional services	35.0	33.3	34.2
Research	36.0	33.0	34.0
Production/quality control	33.0	32.0	33.0
Management	35.0	30.1	30.1

NOTE: Median salaries as of the week of Oct. 4, 2004, for 2003–04 bachelor's graduates with full-time permanent jobs.

WHERE THE JOBS ARE

Fewer graduates find jobs in industry than they did in the past; research services take up the slack

	2003–04 GRADUATES	ALL ACS MEMBERS IN 2004 WORKFORCE
MANUFACTURING	44%	56%
Chemical & related	13	17
Pharmaceutical & related	19	23
Other manufacturing	12	16
ACADEMIA	24	24
University/four-year college	10	18
Medical/professional schools	6	2
High school	7	2
Other academic	1	2
NONMANUFACTURING/ NONACADEMIC	33	20
Analytical/research services	18	9
Government	8	7
Self-employed	0	1
Other	7	3

NOTE: Values are percentages of chemists at all degree levels with full-time permanent employment. Data on ACS members in the workforce are from the 2004 Salary & Employment Survey of ACS members (C&EN, Aug. 16, 2004, page 26).

EVALUATION OF JOB

Ph.D.s are the most satisfied with their employment

	B.A./B.S.		M.S.		PH.D.	
	AGREE	DISAGREE	AGREE	DISAGREE	AGREE	DISAGREE
MY JOB IS						
Related to my field	80%	17%	90%	6%	91%	8%
Commensurate with my training	73	17	85	10	91	7
Challenging	73	17	80	12	87	5
What I expected when I began my studies	—	—	—	—	64	23

NOTE: There is also a neutral option.

found full-time jobs brings out the evolving nature of the chemistry profession, which includes declining dependence on manufacturing. Of the 2004 class, 44% took jobs in manufacturing—well below the 56% of all working chemists with such employment. The big shift is toward analytical and research services, which claimed 18% of the 2004 graduates, in comparison with 9% of chemists already in the workforce.

As to continuing with education, 52% of 2004 bachelor's graduates did so—49% full-time and 3% part-time. Of these, 39% stayed with chemistry. Medicine, pharmacology, and dentistry claimed 25%, 8%, and 4%, respectively. Biochemistry attracted 7%. Master's graduates were much more likely to remain with chemistry: 71%. Medicine, pharmacology, and dentistry together claimed a lower 7%; and biochemistry, 6%.

PH.D. RESPONDENTS to this year's survey are the most satisfied with their employment. An average of 89% agree their jobs are related to their field, commensurate with their training, and challenging. This compares with averages of 85% for master's graduates and 75% for bachelor's.

Employed Ph.D. graduates were also asked if their jobs were what they expected when they began their studies. As usual, a somewhat lower percentage, 64%, said they were.

The results from next year's starting salary survey will be interesting. They will indicate if the job market is finally, if belatedly, back on track for a prolonged period of robust growth as in the '80s and '90s.

So far, the signs are mixed. Nationally, both payrolls and total private employment have grown by more than 2 million over the past year. This is solid, but not spectacular, growth.

On the still negative side, the overall employment level, as determined by a monthly BLS survey of households, has been flat for the past three months. And the volume of classified help-wanted advertisements in C&EN—a good current indicator of the demand for chemists—remains at the depressed level of the past two or three years. ■

FURTHER STUDIES

Male bachelor's graduates are more likely to continue their studies ...

	B.A./B.S.			M.S.		
	MEN	WOMEN	TOTAL	MEN	WOMEN	TOTAL
YES						
Full time	53%	46%	49%	32%	31%	32%
Part time	3	3	3	3	3	3
NO	44	51	48	65	66	66

NOTE: Percentages of 2004 graduates who continued with studies that started in the fall of 2004.

... and fewer than 40% of chemistry bachelor's stay with chemistry

	B.A./B.S.	M.S.
SCIENCE		
Chemistry	38.8%	70.8%
Pharmacology	8.4	0.9
Biochemistry	7.0	5.5
Life sciences	3.5	3.7
Other physical sciences/math	1.5	1.8
ENGINEERING		
Chemical/biochemical	1.3	0.9
Other engineering	0.8	0.9
HEALTH		
Medicine	24.6	5.5
Dentistry	3.9	0.9
OTHER		
Education	2.1	3.7
Law	1.7	3.7
Business management	0.8	0.9
Other	5.8	0.9

LETTERS

Continued from page 8

to the idea that "man is the measure of all things," a philosophical concept that predates Aristotle. Morality comes from the sword—"might makes right"—or the ballot box, "the majority rules." It validates totalitarian governments and anything they do. The absolute standard of morality is gone. Government sets standards by making things legal or illegal, but nothing is right or wrong absolutely. The danger of this idea for the well-being of society cannot be overstated; anything goes.

We have so much to do to educate the public away from fear of chemicals and the chemical industry and toward some reasonable approach to nuclear power and other alternate sources of energy that we can ill afford the time to promote an unprovable, atheistic explanation of creation.

RAYMOND S. MARTIN
Beverly, Mass.

Sparking the youth

I WOULD LIKE TO SUPPORT THE POSITION taken by Gary J. Banuk in the letter "Finding a future for ACS" (C&EN, March 7, page 4). I have been a member of ACS for nearly 50 years and was an interested chemist long before that. Some 80 years ago, I got my first chemistry set, full of chemicals now deemed dangerous in the hands of young people, but it opened a door to a wonderful world that I never left. That early interest was encouraged by my high school science teacher and led to a degree in chemistry in 1939 from Harvard College.

My entire career was in industry, and, like Banuk, I saw the considerable achievements of unsung, practicing chemists who put theory to work in ways that have resulted in the high standard of living we have today. That work still goes on, even though the current fad is all about drugs and biological interactions. In our company, the most productive "idea men" were not the doctoral graduates, but rather those with master's and bachelor's degrees. What differentiated them all was an early fascination with chemistry plus the "catalyst" (if I may use that chemical term) of a dedicated teacher, usually from high school, who had fanned the flame. Certainly my own exposure to the big-name professors was limited and not at all as inspirational as that of my secondary school teachers.

If you want to foster more chemists, start early.

ROBERT M. COQUILLETTE
Lexington, Mass.