

# Current Trends

## Chemists' Employment

5/2000



Department of Career Services  
American Chemical Society

This presentation covers current employment news and discusses the latest trends affecting the employment of chemical professionals. Main subjects covered include: what is happening now, new trends, and what to watch in the near future.

The information presented here comes from multiple sources:

- 1) The ACS Comprehensive Member Surveys (ongoing now for the year 2000)
- 2) The New Graduate Study for the Class of 1999
- 3) The Bureau of Labor Statistics and a survey of about 10 to 15 other sources.

Special mention goes to the *C&EN* "[Employment Outlook 2000](#)" issue from last November. It was one of the best ever compiled by *C&EN* and covers many

of the most rapidly changing and emerging areas of employment of chemical professionals.

## **What Data Tell Us about Careers in Chemistry**

- **more frequent job changes**
- **market remains tight; competition for jobs**
- **knowledge skills applied to wider range of professions and industries**

These three bullets represent the trends that will most affect chemical employment in the near term.

- More frequent job changes: BLS predicts that those entering the job market today can expect to have, during their professional lifetime, 7 to 10 jobs working for 3 to 5 employers.
- Competition for jobs will continue, with new graduate and experienced chemists both moving from traditional employers to the new economy.
- Chemical professionals will be expected to be able to apply their skills to a wider range of industries.

## 1999: Salaries Up, But Jobs Still Tight



“  
**On the one hand, data from the 1999 survey reveal unusually large salary increases for chemical professionals... On the other hand, this year's data indicate, as did last year's, a rate of unemployment among chemists still substantially closer to its historic high than to its historic low.**”

Mike Heylin  
*Chemical & Engineering News*  
August 2, 1999

Note the dichotomy: large salary increases but, at the same time, a relatively high unemployment rate.

In March 1999, ACS chemists who were working showed sustained growth in basic salaries. Postdocs, whose ranks swelled during the high unemployment periods of the mid-1990's, found employment. The changing face of chemical employment appears to affect some chemists far more than others.

The persistence of an elevated unemployment rate is perhaps the most telling indicator of the changing face of chemical employment in the 1990s; it is changing rapidly and constantly.

## Employment Status of Chemists

	<u>1996</u>	<u>1997</u>	<u>1998</u>	<u>1999</u>
<b>Full Time</b>	89.4	90.5	89.8	89.4
<b>Part Time</b>	2.7	2.1	2.4	2.6
<b>Post Doc</b>	2.7	2.3	2.2	2.0
<b>Not Employed</b>				
<b>Seeking</b>	2.9	1.9	2.3	2.2
<b>Not Seeking</b>	2.3	0.8	0.9	1.3
<b>Fully Retired*</b>		2.3*	2.4*	2.5
<b>Overall Unemployment</b>	3.0	2.0**	2.3**	2.3**

\* Fully retired is new category (1997)  
 \*\* Not seeking and fully retired (not in workforce) both dropped from calculation

Source: ACS Comprehensive Salary and Employment Status Surveys

Last year's ACS member-derived data reflects much of the changing dynamics of the profession. While the overall unemployment rate for ACS chemists remained static this year at 2.3 percent, it continues to reflect changes in chemical employment. Those changes affect some chemists far more profoundly than others, especially those who have been employed in industry.

The percentage of industrial chemists unemployed also remained the same (2.6 percent) for both years. The consistency of the unemployment rate for the past two years is due in large part to the continuing high rates of unemployment for older industrial chemists, especially those who worked in industries that have been undergoing rapid change.

The reasonable overall industrial unemployment rate hides a large disparity in unemployment of industrial

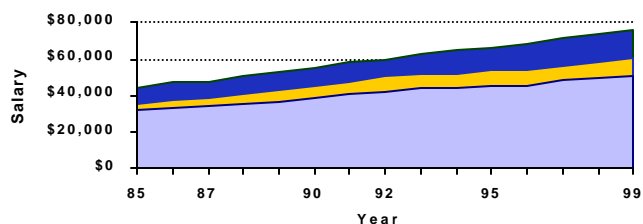
chemists by age:

- Under age 30 – unemployment rate is 1.3 percent
- Ages 30 to 45 – unemployment rate remains a moderate 1.8 percent
- Ages 45 to 59 – unemployment rate grows to 3.2 percent
- Ages 60 through 69 – the rate rises to 6.4 percent

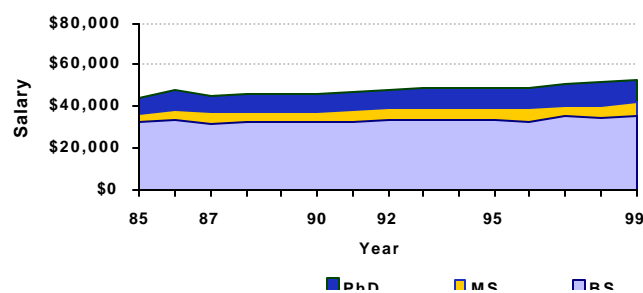
Where the unemployed industrial chemist had worked previously also influenced the unemployment rate. In 1999, petroleum chemists almost reached 5 percent unemployment, whereas those in the expanding pharmaceutical industry had the largest proportion of chemists and a low unemployment rate of 1.4 percent. Pharmaceutical chemists were only bested by those employed in the rubber industry, who posted a 1.2 percent unemployment rate.

# Chemists' Salaries

(in current year dollars)



(in constant 1984 dollars)



Source: ACS Comprehensive Salary and Employment Status Survey Surveys

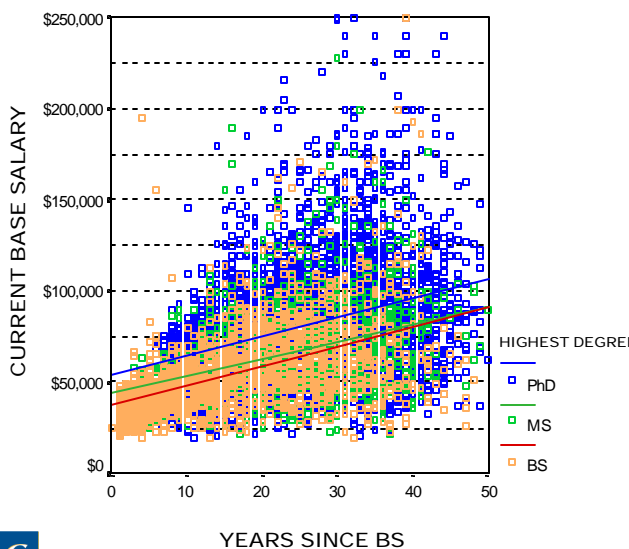
While the overall unemployment picture for chemists in 1999 was mixed, salaries showed strong gains for most individuals. Generally, salary gains met or exceeded the March 1998-99 Consumer Price Index (CPI) increase of 1.7 percent. The CPI is an approximation of inflation.

The overall median salary for chemists was \$68,000 – a 4.6 percent increase over the 1998 median of \$65,000. By degree, salaries increased 1.7 percent to \$50,500 for BS chemists; 5.7 percent to \$61,000 for MS chemists; and 4.1 percent to \$76,000 for PhD chemists. In general, industrial chemists posted larger gains than chemists with other employers.

Overall salary figures are subject to the vagaries of the sample selected each year. Therefore, individual salary gains reflect a more accurate picture of gains in chemists' salaries. When looking at

those chemists who had worked more than one year for the same employer and answered the questions about this year's and last year's basic salary, the overall rise in salaries approached 5 percent. For BS chemists, the individual median increase was 5.3 percent. Both MS and PhD chemists showed individual increases of 4.7 percent. Individuals in industry showed increases of 5 percent and those in government and academic institutions showed increases of 4.2 percent.

## 1999 Salaries for Chemists by Degree and Years Since BS



Source: ACS Comprehensive Salary and Employment Status Survey Survey

Too often, one becomes caught up in an argument of whether salaries reported from the ACS Comprehensive Surveys are inflated or not. For ACS members, we have good evidence that salaries are probably not much inflated. Over the years, the ACS data have been compared to data obtained from employers and from other studies. In the view of most who study these subjects, our data are considered very strong. The problem appears to be a misunderstanding of the median and just how much can be described by these data.

The median is a summary measure of the sample of ACS members and omits a great deal of the description of chemists' salaries. It represents one person, who happens to be placed with 50 percent of the respondents above and 50 percent of the respondents below. The median is best used to observe trends over time rather than a

particular situation. This slide is a picture of salaries of about 9,000 chemists in 1999. The lines in this picture are regression lines by degree earned. This picture alone tells us much more than the median for this particular group. On the other hand, as detailed as this picture is, it leaves off some very interesting information.

The picture does tell us a great deal about the salaries of most of the 1999 ACS working chemists. It shows how widespread and ever more diverse salaries are as one's career progresses. Chemists work everywhere and do many jobs (truly the Central Science) and, consequently, have a wide range of compensation. It also shows that overall, the means of BS and MS degrees are close, whereas, the PhD's start higher and that the gap widens throughout their careers.

One the other hand, this picture does not tell how this group related to any previous group or even how it relates to itself last year. For those observations, we need to look at the summary measures over time.

## Employment Status of Chemists of the Classes of 1998/1999

As of the 2nd week of October

	<u>BS</u>	<u>MS</u>	<u>PHD</u>
Full Time, Permanent	35.7/35.9	49.3/52.8	44.4/42.7
Full Time, Temporary	9.9/9.8	6.6/6.7	3.5/6.1
Part Time, Permanent	0.6/0.8	0.9/0.2	0.5/0.3
Part Time, Temporary	2.6/2.7	1.3/2.0	1.3/1.2
Post Doc or Graduate	42.9/43.5	34.5/31.3	45.3/45.5
<b>Not Employed</b>			
Seeking	5.7/4.8	5.1/5.2	2.5/2.4
Not Seeking	2.6/2.4	2.3/1.7	2.4/1.8
<b>Overall Unemployment*</b>	<b>5.8/4.9</b>	<b>5.2/5.3</b>	<b>2.6/2.4</b>



\* Not seeking dropped from calculation

Source: ACS New Graduate Surveys

In the Spring of 1999, *C&EN* wrote of a possible “cooling off” of the market for new graduates – down from the 1998 results. We now have the recently released data for the Class of 1999. Except for pharmaceuticals, the “cooling off” has taken place in most of the traditional fields of chemistry, but not for many of the new fields, such as biotechnology.

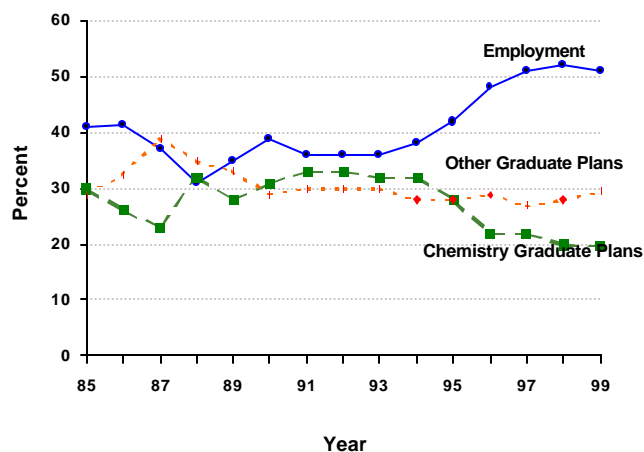
The 1999 bachelors’ chemist continues to head for the workforce and find jobs; their Fall unemployment rate declined by almost a full percentage point. However, a relatively large number start their working careers in temporary positions.

MS chemists showed considerable improvement in the proportion who found full-time permanent employment.

New PhD’s found a slightly tighter market than their 1998 counterparts.

More of them took temporary positions and the figures for postdoctorals did not decline. Compare this to the decline in postdoctorals from 51.5 percent in 1997 to 45.3 percent in 1998.

## Post-Graduation Plans of BS / BA Chemistry Graduates



Source: ACS New Graduate Surveys  
ACS Department of Career Services

Perhaps one of the most telling trends of the 1990's was a change in post-graduation plans of bachelor's degree-holders. Traditionally, about one-third went to work, one-third to graduate school in chemistry, and one-third to other graduate programs, such as medicine, engineering, etc. Beginning in about 1996, this rule of thumb no longer holds.

The job market has improved after nearly a decade of tough employment news for chemical professionals. Bachelor's chemists have been opting to go straight into the workforce in greater numbers (and proportions). At the same time, the proportion going into chemistry graduate programs continues to decline and new bachelors' going into other advanced studies stabilized. This was also reflected in smaller populations of domestic undergraduates in graduate programs, overall declining figures for PhD graduates, and the growth in

master's degrees for the older, experienced chemists.

In summary, more BA/BS graduates are going to work, finding jobs, and receiving higher wages. This trend has continued for the past several years and, in 1999, the bachelor's graduates also improved their Fall unemployment figures.



## Starting Salaries: Inexperienced Chemists by degree and in \$1000s

Class	BS	MS	PHD
1990	23.0	30.0	44.0
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	37.4	54.0
1998*	29.5	38.5	59.7
1999*	30.0	42.0	61.0



\*As of the 2nd week of October

Source: New Graduate Surveys

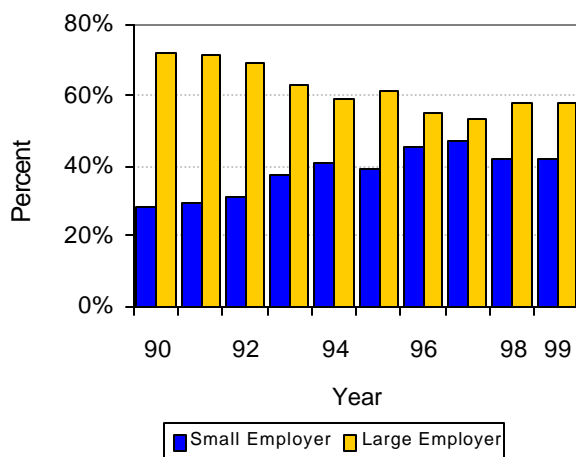
This year, overall starting salaries for new graduates hit new heights; medians for BA/BS chemists reached \$30,000; MS chemists reached \$42,000; and PhD's reached \$61,000. Although most new graduates who went to work in industry hit those benchmarks a few years ago, these new figures for the whole class of 1999 portend significant increases for non-industrial chemists, especially at the BA/BS level.

After showing much salary fluctuation in the 1990's, MS chemists have displayed strongly increasing starting salaries for three years in a row. In 1999, over 70 percent of new MS chemists went to work in industry where their median starting salaries were \$43,000 in non-manufacturing and \$44,000 in manufacturing sectors, illustrating that where a chemist works is an important determinant. (Note that this is the smallest group in numbers since many recent MS chemists are experienced –

receiving their degrees while working or after a few years in the workforce.)

Finally, the data for inexperienced PhD chemists may be biased towards the low side since it is affected by the fact that new graduates who go to smaller schools work as academics without a postdoctoral fellowship and receive roughly one-half the salary as those going to industry.

## Inexperienced Chemistry Graduates Employed in Industry, 1990-1998 by Size of Company

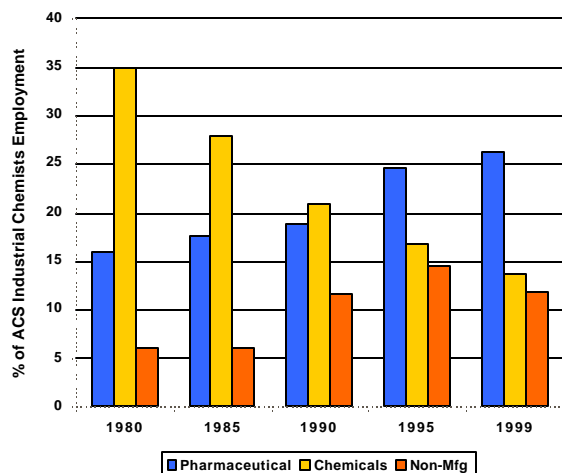


\*Small Companies=Less than 500 employees  
Source: ACS New Graduate Surveys

This illustrates an important trend that, for the past several years, has had a strong effect on chemical employment: the growth of employment in small businesses. This has many ramifications for chemists. For example, the type and level of compensation, the type of experience gained, and most importantly, how one goes about finding these jobs.

The ACS Professional and Workforce News publication, [\*Chemical Employment in Smaller Companies\*](#), addresses some of the ramifications and techniques for locating positions at small companies.

## Shift in Employment of ACS Members by Industrial Segments: 1980-1999



Source: ACS Comprehensive Salary and Employment Status Surveys

One of the most pronounced changes in the employment of chemical professionals in the past decade or so is the rapid change of major employers (for non-academic chemists).

This slide illustrates that, since 1980, “classical” chemical companies have been replaced by the pharmaceutical industry as the major employer of ACS industrial members.

Also, with the advent of outsourcing in the past decade, plus the rapid growth on small research biotechnology laboratories, the percent of ACS members working in non-manufacturing, which includes analytical labs and contract firms, has grown from 6 percent to 15 percent of non-academic employment.

Department of Labor predictions suggest that this trend will continue and increase rapidly over the next decade. This

means that chemical scientists must remain flexible in their approach to employment and consider opportunities outside of chemical companies.

## **Where Are The New Industrial Chemistry Jobs?**

- **Pharmaceuticals**  
**Biotechnology**  
**Electronics/computers**  
**Personal care**  
**Specialty chemicals**
- **Regional:**  
**East North Central**  
**Middle Atlantic**  
**Pacific Coast**  
**Southern Atlantic**
- **Start-up companies**
- **All size companies**  
**Especially small**

Source: ACS Salary Surveys  
BLS Occupational Outlook Handbook  
Career Guide to Industries

While continuously subject to change, this slide presents a list of where recent graduates most often found their first full-time employment.

The industrial segments highlighted are a reflection of the aging societies of highly industrialized parts of the world. Thus, much of the growth in employment is related to aging society – pharmaceuticals, biotechnology, and personal care.

Where the new grads have found work recently is also reflected in the Bureau of Labor predictions of future growth for chemists.

## Employment Growth Areas for Chemists

- **Research and testing services\***
- **Pharmaceuticals/biotechs/  
medical instruments**
- **Consulting & contracting**
- **Electronic manufacturing**
- **Transportation & public utilities**
- **Education - public and private**
- **Local governments**

\* Largest predicted growth area



Source: /Bureau of Labor Statistics 1999

Every two years the Bureau of Labor Statistics estimates the growth of the US workforce by occupation and publishes these data as an ["Occupational Outlook Handbook."](#) Their historical record for accuracy is impressive. The 1998-2008 biennial edition has just been released..

Small, independent research and analytical labs are not only expected to grow the fastest proportionately, but also grow the most numerically.

On the other hand, with the exception of drugs and some specialty chemicals, traditional areas of employment for chemical scientists in manufacturing are expected to decline, with the largest losses coming in basic chemicals, plastics, and the tobacco industries. Where chemists go to find work, especially in industry, is changing dramatically and rapidly.

The large predicted growth of chemical employment in what is known as the "service" sector (including contract research, analytical laboratories, and

consulting) is reflected in recent trends of ACS data - the growth in employment in small businesses and in non-traditional areas.

In support of the BLS predictions, the 10-year change for drugs in 1996 actually occurred by 1998, but we already knew that rapid growth has occurred in these areas over the past few years.

## **Chemical Employment: Universal Factors**

- **Restructuring/acquisitions/mergers**
- **Changing nature of R&D and business orientation**
- **International competition: world-wide research, manufacturing, marketing**
- **Use of advance technologies and increasing multidisciplinary approach**
- **Outsourcing and contract and temporary employment**
- **Production emphasis; satisfying immediate needs of customer today's "bottom line!"**

Now switching to the general dynamics of chemical employment:

This slide illustrates some of the major factors that affect chemical employment. These are the dynamics that every chemist should be aware of –they may affect their own job, no matter where they work.

In particular, educators must be aware of the fields where their students will work and what impact these trends will have on their research programs. Corporations must remain aware of how their companies fit into the economy. Chemists working in industry must know their jobs and how they fit into the company and its strategic thrusts.

## 1999: Best of Times?




“

**The message... is that chemistry offers its practitioners good salaries that, of late, are increasing in post-inflation real terms. But not all areas of chemical employment are equal in their ability to generate new jobs. The best thing all of us can do is be flexible, keep our skills razor sharp; always seek additional training, whether from the classroom or the Web; and be ready for change. ”**

James Ryan  
*Today's Chemist at Work*  
August, 1999

This quote represents the bottom line for today's chemical professional. He or she must:

- Keep abreast of trends, both within their fields of expertise and within the economy as a whole.
- Become a “lifetime learner.” Maintain their knowledge base in their own fields but become knowledgeable in relevant areas.
- Be able to work across fields, in many different settings.
- Remain flexible.



“  
**It is not necessary  
to change.  
Survival is not  
mandatory.”**

W. Edwards Deming as quoted in  
*Today's Chemist at Work*  
August, 1999

This quotation, attributed to W. Edwards Deming (the American statistician, educator, and consultant who is considered the father of quality control in industry) should become your motto!



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