EARLY CAREERS OF CHEMISTS

A REPORT ON THE AMERICAN CHEMICAL SOCIETY'S STUDY OF MEMBERS UNDER AGE 40

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ACKNOWLEDGMENTS

This report presents detailed results of the Early Careers of Chemists Survey conducted in 2001. An initial review and analysis of the survey was published in the December 24, 2001, issue of *Chemical & Engineering News*.

The ACS Council Committee on Economic and Professional Affairs (CEPA) and its Subcommittee on Surveys planned and provided general oversight of the survey, its analysis, and the related symposium. Members of the Subcommittee were Suzanne Blackburn, John Bingham, H.N. Cheng, and William Suits. The Committee is very grateful to the more than 4,400 ACS members, under age 40, who responded to the survey. They provided a valuable service to the profession and fellow ACS members.

Two taskforces were formed during the survey process. The first taskforce, initiated in 1999 by request from the Younger Chemist Committee (YCC), was formed to study the issues and create the survey instrument. ACS Members of the first taskforce were Suzanne Blackburn, Dinah R. C. Bosley, Jim Long, Scott Luaders, Heather Anne McKechney, Shawn Roach, and Brian Treco. We are also grateful to Roberta Sangster, Bureau of Labor Statistics, Patrick Mulvey, American Institute of Physics, Steven Smith, P.I., Careers of Physical Scientists Project, for their valuable advice and comments. Mary Jordan, senior research analyst, and Kemie Smith, program assistant, ACS staff, supported the taskforce.

The second taskforce planned the survey publication and the symposium presented at the Spring 2002 ACS National Meeting in Orlando. ACS members of this taskforce included Suzanne Blackburn, H.N. Cheng, Jim Long, and YCC representatives Michael Beverly, Susan Hendrickson, and Adam Myers.

The data analysis for and writing of this report was done by Philip Broyles, E-Statsman and the Department of Sociology/Anthropology, Shippensburg University. Mary Jordan, senior research analyst of ACS' Department of Career Services conducted the survey and produced the dataset. She was assisted by program assistant, Pamela Steiner.

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PREFACE

The American Chemical Society is dedicated to providing programs and activities to facilitate the career development of chemical professionals and has a long history of effectively reporting on professional chemical employment. The ACS Committee on Economic and Professional Affairs (CEPA) is charged with fostering ongoing improvements in the economic and professional status of chemical scientists. To carry out this mission, CEPA conducts periodic fact-finding studies on supply and demand, compensation, and other matters that affect the economic status of the chemical profession and monitors the state of the economic and professional affairs of chemical scientists.

CEPA works with the ACS Department of Career Services (DCS) to provide programs, services, and publications to assist chemists in making career decisions. In particular, CEPA directs the development of work force studies about employment and industry trends and issues that affect the chemical profession. The published study reports are intended to provide hard data on the salaries and employment of chemists, to give an overview of trends in the chemical enterprise and to guide chemists to areas of emerging technologies and employment opportunities.

During the last part of the 20th Century, changes in how and why we work became apparent, particularly among younger chemists. With dual career couples, shifting demographics of the scientific workforce, and the longest sustained period of economic growth our country has seen, the career norms of the past could not be applied to the present. Therefore, the Early Career Chemists study was conceived to identify the resources and experiences that younger chemists use to start and develop their careers.

This study is intended to examine current careers; to follow career paths; to see the relationship of careers to education, salary, satisfaction, and expectations; to learn what skill sets are most valuable to chemists; to examine the effects of a hiatus or family obligations; and to identify how younger chemical scientists are planning ahead for their own careers (such as anticipating career plateaus, retirement needs).

SUMMARY

In this survey, 4,352 ACS members under 40 are asked about their educational and employment experiences – 2,726 men and 1,547 women specified their sex. Eighty-one percent of the participants are white, 12% are Asian, three percent are Hispanic, two percent are African-American and three percent are of other racial origins. Most participants are U.S. citizens (87%). However, eight percent of the participants are on permanent resident visas and five percent are on other visas. They are highly educated: 61% of the men and 49% of the women have doctorates.

Some of the important highlights of this survey are:

EDUCATION

- Young chemists rate the quality of undergraduate education very highly, especially basic chemistry, technical problem-solving and math. However, they show some concern for the quality of training in computer programming and scientific software.
- Most of the chemists are mentored during their education by faculty and peers. Women and black chemists are less likely than white, male chemists to be mentored.
- There still is notable discrimination in science education. Almost one-third of women encountered sex discrimination in college. Just over 55% of Blacks, 21.4% of Asians, 14.7% of Hispanics and 7.7% of other racial minorities experienced racial discrimination.
- Young chemists are very satisfied with their educational experiences. Few of them view education as primarily a pragmatic goal.

EMPLOYMENT STATUS

- The employment situation for chemists under 40 is very good. Only 1.1% of chemists are unemployed and seeking employment. Employment is strongest in industry where 96% of the industrial workforce is employed full-time in permanent positions.
- A surprising number of young chemists ideally prefer full-time work part of the year rather than year-round employment – 15.4%. Another 8.6% prefer part-time, year-round work. Women with children are the most likely of chemists to prefer alternatives to full-time, year-round employment.
- Almost 50% of chemists under 40 work in research and development. Another fifth of the workforce is employed in analytical services and production/quality control. Women tend to be concentrated in the lower paying fields such as teaching and analytical services.
- Only 20% of young chemists worked outside their field at some point in their careers. Most did so because they perceived a lack of jobs.

SALARIES AND BENEFITS

- The pattern of median salaries for chemists under 40 is similar to that of all chemists. The median salary for chemists with a doctorate is $72,500. For chemists with a master's it is $56,500 and for those with a bachelor's it is $48,500.
- Chemists in industry earn more than their peers in government and academics. Of the work functions, R&D management and patents and licensing pay the most.
- Black, Hispanic and women chemists earn less than white, male chemists.
- Almost all chemists under forty have pension plans and 75% have some educational benefits.

WORK ISSUES

- Overall, young chemists highly rate their training (formal and informal) for important work activities such as critical thinking, analyzing data, knowledge of discipline, oral presentation and writing. However, they are concerned with the quality of management training.
- Women and black chemists are less likely than other chemists to attend management training and are under-represented as supervisors/managers.
- Young chemists are positive about their current position. They say their education is commensurate with their current position and that their position is professionally challenging. Very few expect to lose their job in the next five years.
- There is considerable employment discrimination. Over one-third of women experience sex discrimination at work. Just under half of black, one-quarter of Asian and 15% of Hispanic chemists experience racial discrimination in the workplace.
- Job satisfaction is generally high among young chemists.

CAREER TRANSITIONS

- Most young chemists have changed employers only once during their career. The major reasons for changing employers are better pay and promotion, working conditions, and job location.
- Only 27.9% of employment changes are between different employment sectors. Most movement between sectors occurs between academics and industry.
- Few chemists under 40 have experienced a break in employment for six months or more. The most common reasons for these breaks are termination, moving for a spouse and maternity/childcare.
- Chemists are almost evenly divided on whether their hiatus had any impact on their career. Almost half say their hiatus had no effect on their career, 36.4% say it hurt their career and 17.4% say it helped their career.

METHODOLOGY

The major objective of this survey was to identify and describe the educational and employment trends of chemists early in their careers.

For this survey, questionnaires were mailed to a random sample of 10,000 ACS members under age 40. Just over 4,400 surveys were returned, for a response rate of 44%. Thirty-one respondents who had an educational level less than a bachelor's degree were removed from the sample because there were too few of them for comparison with other educational groupings. An additional 60 respondents were omitted from the sample because they were not in the workforce – unemployed and not seeking work.

1 ACS MEMBER RESPONDENTS UNDER AGE 40

QUESTIONNAIRES MAILED	10,000
TOTAL RESPONSE	4,412
UNEMPLOYED, NOT SEEKING WORK	60
CHEMICAL WORKFORCE	4,352

The final sample consisted of 4,352 ACS members under 40 with a bachelor's degree (or higher degree) who were in the chemical workforce. All items where a respondent did not answer a particular question analyzed were treated in a "pair-wise" fashion in the analysis and were omitted as needed for each separate analysis. Consequently, the actual number of cases varied by analysis.

To identify the basic trends of the data while maintaining content suitable for a general readership, the survey data was analyzed with univariate and bivariate descriptive statistics. Chi-square tests of significance were used for crosstabulation tables and ANOVA and difference of means tests were used for variable means. Not all of the complexity of the relationships between variables can be captured by such limited analyses. In some cases, more complex analyses were conducted to further describe the relationships among the variables. However, multivariate explanatory analysis generally fell beyond the scope of this report.

All tests of statistical significance were at the .01 level of significance. A more restrictive criterion than the usual .05 level of significance was used because in large samples small differences in proportions are typically significant at lower levels of significance, even though they may have little substantive importance. Raising the threshold level for significance reduces the number of relationships that are statistically significant yet unimportant. Nevertheless, interpretation of, and extrapolation from, these findings should be done cautiously. Many results are clear and unambiguous. Others are statistically significant but small and have little substantive importance.

For analysis based on race, the relatively small number of cases limits the depth of inquiry. Consequently, results based on race should be interpreted as preliminary indications of racially based differences. Further study with a larger sample of minority chemists is needed to confirm and further disentangle the effects of race.

DEMOGRAPHICS

The age of the chemists in this sample ranges from 21 to 39 years. Most of the chemists, however, are over thirty years of age. The mean age is 33.2 years – the median is 34 years. There are relatively few chemists under thirty in the sample – approximately 18%. And less than three percent of the chemists are under 25 years, which is consistent with the proportion of ACS members in this age group. At this age, many chemists are pursuing graduate studies rather than working. Others are not fully integrated into the profession and typically are not active in professional organizations.

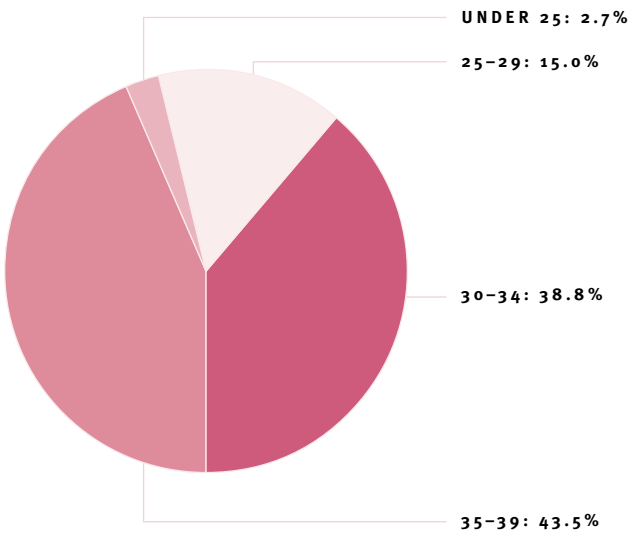
Overall, the demographic profile for chemists early in their careers closely resembles that of the general ACS membership. An overwhelming majority of chemists under 40 are married, white, male, and US citizens.

SEX

Almost two-thirds of chemists under 40 are men and only 36.2% are women. This sex imbalance is greater among chemists 30–40 years of age than it is among chemists under 30. Among chemists under 30, there is nearly an equal number of men and women. However, men outnumber women 2 to 1 among chemists aged 30-39. This largely reflects the increasing presence of women in chemistry over time, which is an encouraging sign of opportunity for women in science. It is also interesting that the sex imbalance is less pronounced among blacks and Hispanics.

Just over 50% of black and 42.6% of Hispanic chemists under 40 are women. Women chemists are also younger than their male counterparts. The mean age for women is 32.6 years and for men it is 33.6 years.

G1 AGE DISTRIBUTION OF CHEMISTS UNDER AGE 40



Women chemists are more likely than their male counterparts to be single – 30.1% of women compared with 25.2 % of men. This partly reflects the younger age of women chemists. Almost 25% of the women in the sample are under 30 years of age but only 14% of the men are under 30. This age difference may also partly explain why women are less likely than men to have children – 38.7% versus

51.3%. Similar to national trends, the families of young chemists average two children, with the average age of the oldest and youngest children being 7 and 4 years, respectively. Women chemists are also more likely than men to be married to a scientist (chemist or other) – 35.9% of women compared with 27.3% of men.

DIVERSITY

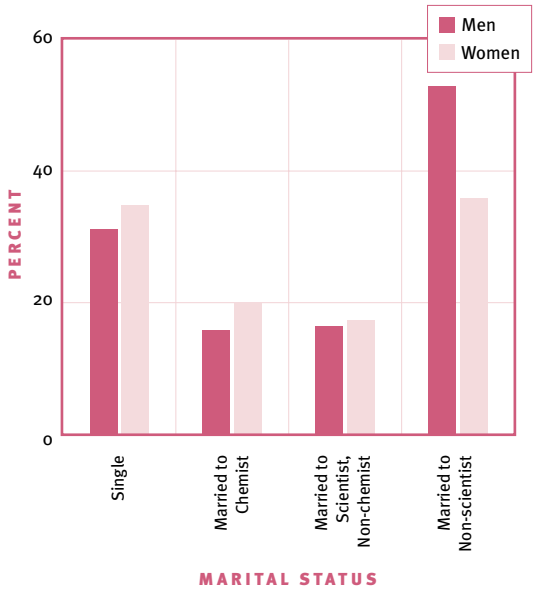
Almost 20% of the chemical workforce under 40 is composed of members of minority groups. The largest of these groups is Asian Americans who make up 12.3% of the workforce under 40, which is over three times their representation in the general population – 4%. Hispanics and blacks, on the other hand, are

2 PERCENT AND AGE OF CHEMISTS BY SEX, RACE, CITIZENSHIP AND MARITAL STATUS

		PERCENTAGE	MEAN AGE
SEX	MEN	63.8%	33.6
	WOMEN	36.2	32.6
RACE	ASIAN	12.3%	34.5
	BLACK	1.9	32.9
	HISPANIC	3.3	32.7
	WHITE	80.6	33.0
	OTHER	1.8	33.2
CITIZENSHIP	U.S. NATIVE	80.7%	32.9
	U.S. NATURALIZED	5.5	34.7
	U.S. PERMANENT RESIDENT VISA	8.3	34.5
	OTHER VISA	5.4	33.4
MARITAL STATUS	SINGLE	27.4%	31.6
	MARRIED/PARTNERED TO A CHEMIST	15.7	33.8
	MARRIED/PARTNERED TO A SCIENTIST, NON-CHEMIST	14.8	33.9
	MARRIED/PARTNERED TO A NON-SCIENTIST	42.1	33.8

NOTE: Percentages may not sum to exactly 100.0% due to rounding of components.

G2 MARITAL STATUS BY SEX



under-represented in the chemical workforce relative to their representation in the general population. Only 3.3% of chemists are Hispanic and 1.9% are black.

Most young chemists are citizens of the United States – 86.2%. However, a modest number of chemists are immigrants – 13% of chemists under 40 are on visas. Most immigrants are men; Three out of every four visas are held by male chemists. Of the minority groups, Asians are most likely to be in the United States on a visa. Over 55% of Asian chemists under 40 are on visas, most have permanent residency. Only 18.5% of blacks and 14.7% of Hispanics are on visas.

3 SEX OF CHEMISTS BY AGE AND RACE

		MALE	FEMALE
AGE	UNDER 25	49.1%	50.9%
	25–29	52.3	47.7
	30–34	63.5	36.5
	35–39	68.8	31.2
RACE	ASIAN	65.9%	34.1%
	BLACK	49.4	50.6
	HISPANIC	57.4	42.6
	WHITE	65.9	34.1
	OTHER	66.2	33.8

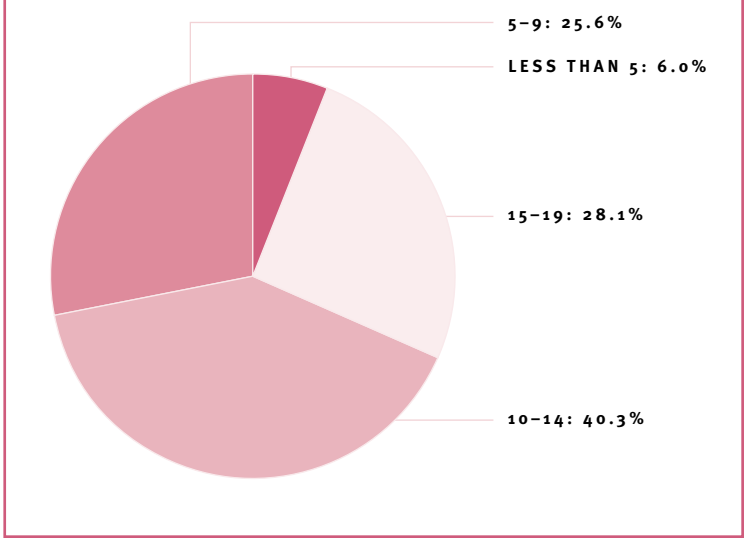
4 RACE OF CHEMISTS BY CITIZENSHIP

		ASIAN	BLACK	HISPANIC	WHITE	OTHER
CITIZENSHIP	U.S. NATIVE	15.6%	71.6%	71.3%	91.5%	69.2%
	U.S. NATURALIZED	28.1	9.9	14.0	1.6	7.7
	U.S. PERMANENT RESIDENT VISA	35.5	7.4	9.8	4.0	11.5
	OTHER VISA	20.9	11.1	4.9	2.8	11.5

EDUCATION

The majority of the chemists in this survey received bachelor's degrees ten or more years ago – only six percent of chemists graduated less than five years ago. However, most of the chemists (80.4%) have attended some graduate school, too. Almost 57% of chemists surveyed have doctorates and 17% have master's degrees. The remaining 26% have (terminal) bachelor's degrees.

G3 YEARS SINCE BACHELOR'S DEGREE OF CHEMISTS UNDER AGE 40



The educational level of chemists under 40 varies by sex, age, race and citizenship. Women are less likely than men to have doctorates – 48.7% of women compared with 61.3% of men. And women are more likely than men to have a terminal bachelor's degree – 32.1% versus 22.9%.

Predictably, older chemists are more likely than younger chemists to have doctorates. The percentage of chemists with a doctorate increases with each successive age group. While there are no doctorates among chemists under 25, almost 70% of chemists between 35–39 years of age hold doctorates.

There is considerable variation in educational level among different racial groups. Asian chemists have the highest level of educational attainment. Almost 80% have doctorates, 13.9% have master's degrees and only 7.6% have bachelor's degrees. Blacks and Hispanics are under-represented among chemists with doctorates – 38.6% of blacks and 43.4% of Hispanics have doctorates.

Most of the chemists immigrating to the United States have doctoral degrees. Over 86% of chemists on resident or other visas have doctorates. For many of these immigrants, entrance to the U.S. was obtained because of their educational credentials.

UNDERGRADUATE EDUCATIONAL EXPERIENCES

Less than half of all young chemists completed requirements of an ACS-approved degree program – 44.1%. There is no difference by sex. However, access to ACS-approved programs varies greatly by race and may reflect notable racial disadvantage. Asians and blacks are much less likely to complete requirements of an approved program than are white

5 HIGHEST DEGREE OF CHEMISTS BY SEX, AGE, RACE AND CITIZENSHIP

		BS	MS	PHD
	ALL	26.2%	17.0%	56.8%
SEX	MEN	22.9%	15.8%	61.3%
	WOMEN	32.1	19.2	48.7
AGE	UNDER 25	97.4%	2.6%	—
	25–29	52.3	22.1	25.5%
	30–34	21.9	18.3	59.9
	35–39	16.5	14.9	68.6
RACE	ASIAN	7.6%	13.9%	78.6%
	BLACK	42.2	19.3	38.6
	HISPANIC	32.2	24.5	43.4
	WHITE	28.3	17.3	54.4
	OTHER	30.8	12.8	56.4
CITIZENSHIP	U.S. NATIVE	30.7%	18.2%	51.0%
	U.S. NATURALIZED	17.2	15.5	67.2
	U.S. PERMANENT RESIDENT VISA	3.1	10.3	86.7
	OTHER VISA	2.6	11.1	86.3

chemists. For Asians, participation in all of these undergraduate programs may be low because of the high number of foreign born and educated Asians – both citizens and those on visas.

Chemists' participation in ACS Student Affiliate Programs is even less common. Only 36.4% of young chemists participated in ACS Student Affiliate Programs during their undergraduate years. Women's participation rates are higher than those of men, 41% versus 34.1%. Fewer Asian, Hispanic and "other" minority chemists participate in these programs than do white and black chemists. Approximately 40% of whites and blacks participate in student affiliate programs but only 34.3% of Hispanics, 30.8% of other minorities and 11.8% of Asians participate.

Chemists' participation rates for undergraduate internships, co-op or volunteer activities are also rather modest. Just over 30% of chemists participate in co-op or internship programs and 17.7% participate in volunteer activities. Women are more likely than men to participate in both of these activities. Just over 35% of women chemists participate in co-op or internships and 22.8% participate in volunteer work. For men, 27.1% participate in co-op or internships and 14.9% participate in volunteer work. There is also considerable racial variation in participation rates. Blacks are most likely of the

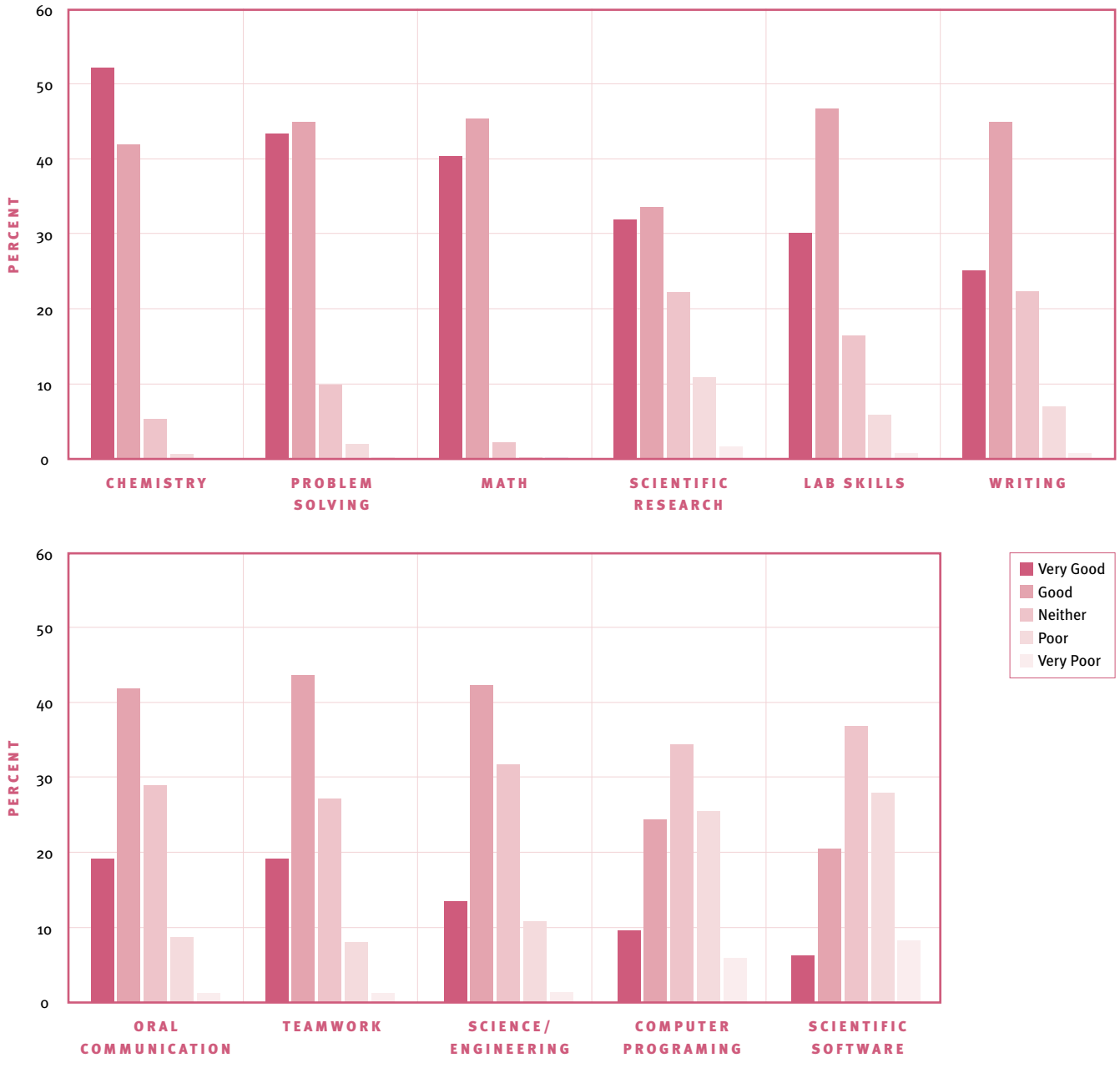
6 PARTICIPATION OF CHEMISTS IN UNDERGRADUATE PROGRAMS AND ACTIVITIES BY SEX AND RACE

		ACS STUDENT AFFILIATE	INTERNSHIP CO-OP	VOLUNTEERISM	STUDY ABROAD	ACS-APPROVED DEGREE PROGRAM
	ALL	36.4%	30.3%	17.7%	7.1%	44.1%
SEX	MEN	34.1%	27.1%	14.9%	6.6%	44.1%
	WOMEN	41.0	35.8	22.8	7.8	45.5
RACE	ASIAN	11.8%	17.5%	12.1%	14.6%	17.5%
	BLACK	39.8	44.6	33.7	1.2	34.9
	HISPANIC	34.3	29.4	16.1	3.5	40.6
	WHITE	40.6	31.8	18.1	6.3	48.6
	OTHER	30.8	37.2	23.1	6.4	46.2

minority groups to participate in co-op or internships, 44.6%, and volunteerism, 33.7%.

Study abroad is the least common undergraduate experience. Only 7.1% of young chemists study abroad. Women are slightly more likely than men to study abroad. Asians are most likely of the minority groups to study abroad – 14.5%. Blacks and Hispanics are least likely to study abroad – 1.2 and 3.5%, respectively. This partly reflects differences in educa-

G4 QUALITY OF UNDERGRADUATE EDUCATION



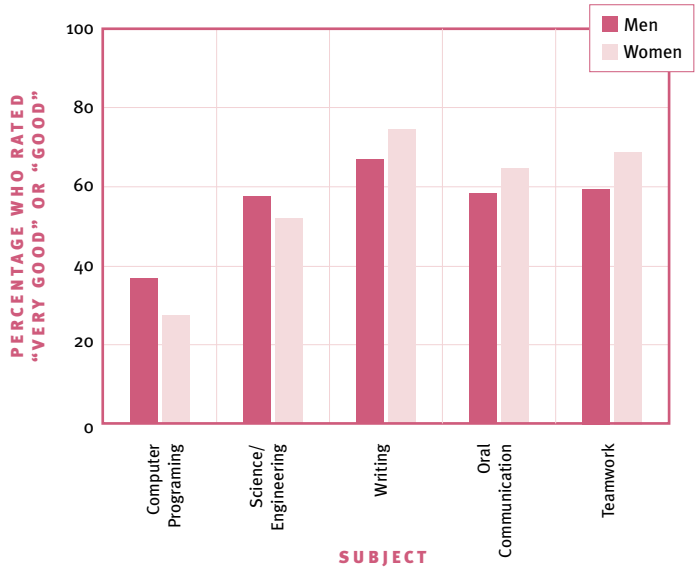
tional level – chemists with doctorates are more likely to study abroad than are chemists with lower levels of education.

QUALITY OF UNDERGRADUATE EDUCATION

Overall, young chemists rate their undergraduate education highly. Over 85% of survey respondents rate their education in basic chemistry, technical problem-solving, and math as "good" or "very good." Ratings for training in scientific research, lab skills, other sciences, oral communication, writing and team work are also good, ranging from 55–77% agreeing that their education was "good" or "very good." Their major concern is for undergraduate training in computer programming and scientific software. Only 24% of chemists rate their training in scientific software as "good" or "very good." And just 30% rate their training in computer programming as "good" or "very good."

There are few significant sex differences in these ratings. Somewhat stereotypically, women are more satisfied than men with their education in writing, oral communication and teamwork and less satisfied with their education in computers and science.

G5 SIGNIFICANT SEX DIFFERENCES IN RATINGS OF UNDERGRADUATE EDUCATION



GRADUATE SCHOOL

Over 80 percent of young chemists surveyed attended some graduate school. Men are more likely than women to attend graduate school – 82% of men compared with 76.1% of women. Among racial groups, Asians are the most likely and black chemists are the least likely to attend graduate school – 86.9% of Asians and 69.5% of blacks compared with 79.9% of white chemists. The most frequent reason for attending graduate school is to get a better job – 67.3%. Many of the chemists also cite the availability of financial support for graduate school and a desire to learn more about chemistry as reasons for attending graduate school.

There are few differences between sexes. Women are influenced a little more by the availability of financial support, career uncertainty and desire to study a different field than are men. Men, on the other hand, are influenced more by the desire to get a better job and to learn more about their chosen chemistry field

7 CHEMISTS' REASONS FOR ATTENDING GRADUATE SCHOOL BY SEX AND RACE

		% ATTENDED	FINANCIAL SUPPORT	UNCERTAIN CAREER PATH	LACK OF JOB OPPORTUNITY	BETTER JOB THAN WITH BS	LEARN MORE ABOUT FIELD	DIFFERENT FIELD
	ALL	80.4%	47.3%	27.4%	11.9%	67.3%	50.6%	12.8%
SEX	MEN	82.8%	46.0%	25.4%	12.0%	68.6%	52.5%	11.6%
SEX	WOMEN	76.1	50.1	30.9	11.8	64.9	47.1	15.3
RACE	ASIAN	86.9%	35.7%	17.5%	7.0%	58.3%	55.7%	11.4%
RACE	BLACK	69.5	49.1	26.3	14.0	70.2	45.6	24.6
RACE	HISPANIC	75.5	43.5	17.6	13.0	64.8	61.1	7.4
RACE	WHITE	79.9	49.6	29.4	12.7	69.3	49.7	12.8
RACE	OTHER	79.2	42.6	27.9	9.8	54.1	50.8	23.0

NOTE: Question instructed respondents to mark all that apply. Therefore, rows will not sum to 100.0%.

than are women. There are a few differences among racial groups. Among them, blacks and whites are more concerned with financial support, desire to get a job and career uncertainty than are other races.

MENTORS

Most chemists are mentored during their education. Only 12.7% of chemists have no mentoring during their education. Faculty advisors are most commonly mentors, followed by other faculty members and peers. There are significant sex differences in mentoring experiences. Women are less likely than men to be mentored – 15.6% of women are not mentored compared with 10.8% of men. And women are less likely than men to be mentored by their faculty advisors – 65.8% versus 75.4%.

The overall mentoring experiences of minority groups varies little. However, blacks are the least likely to be mentored and Asians are the most likely to be mentored. Just over 18% of black chemists are not mentored and only 8.9% of Asian chemists are not mentored.

As to be expected, mentoring varies greatly by degree. Chemists pursuing bachelor's degrees are much less likely to be mentored than are chemists pursuing doctorates. While 24.8% of chemists at the bachelor's level are not mentored, only 5.5% of chemist at the doctoral level are not mentored.

DISCRIMINATION

The findings of this survey suggest there is notable discrimination in science

8 MENTORS FOR CHEMISTS DURING HIGHEST DEGREE PROGRAM BY SEX, RACE AND HIGHEST DEGREE

		FACULTY ADVISOR	OTHER FACULTY	PEERS	OTHER	NONE
	ALL	71.9%	39.0%	41.6%	7.1%	12.7%
SEX	WOMEN	65.8%	39.2%	41.9%	8.9%	15.6%
SEX	MEN	75.4	38.9	41.7	6.3	10.8
RACE	ASIAN	82.5%	21.3%	25.8%	2.5%	8.9%
RACE	BLACK	65.1	41.0	32.5	7.2	18.1
RACE	HISPANIC	70.6	32.2	42.7	7.0	11.9
RACE	WHITE	70.5	41.3	44.1	7.8	13.0
RACE	OTHER	67.9	42.3	47.4	10.3	15.4
HIGHEST DEGREE	BACHELOR'S	44.3%	43.3%	27.0%	8.4%	24.8%
HIGHEST DEGREE	MASTER'S	62.2	31.9	39.6	6.2	17.7
HIGHEST DEGREE	DOCTORATE	87.4	39.1	48.9	6.8	5.5

NOTE: Question instructed respondents to mark all that apply. Therefore, rows will not sum to 100.0%.

9 CHEMISTS' EXPERIENCED DISCRIMINATION IN EDUCATION BY SEX, RACE AND CITIZENSHIP

		% EXPERIENCING DISCRIMINATION
SEX	MEN	2.1%
	WOMEN	29.8
RACE	ASIAN	21.4%
	BLACK	55.4
	HISPANIC	14.7
	WHITE	1.7
	OTHER	7.7
CITIZENSHIP	U.S. NATIVE	0.4%
	U.S. NATURALIZED	12.2
	U.S. PERMANENT RESIDENT VISA	20.6
	OTHER VISA	20.1

education. Almost 30% of women chemists experience sex discrimination during their education – 2.1% of men say they experience sex discrimination. Racial discrimination in education is even more pronounced. Just over 55% of blacks, 21.4% of Asians, 14.7% of Hispanics and 7.7% of other minorities experience discrimination based on race.

Immigrants also face considerable discrimination. Just over 20% of chemists on visas – permanent residency or other – experience discrimination because of their nationality. Even some foreign-born chemists who are naturalized citizens experience discrimination – 12.2%.

EDUCATIONAL DEBT

Over half of young chemists have educational debt upon graduation with his or her highest degree, which ranges from $500 to over $100,000. The median debt is $11,000. Women have $1,000 more debt, on average, than have men. Black chemists have an average of $4,000 more debt than have white chemists.

Not surprisingly, educational debt appears to have increased over time with inflation. Chemists who graduated less than 5 years ago have an average of $18,000 of total educational debt whereas chemists who graduated 5–9 years ago had an average of $13,000 of debt and chemist who graduated 10-19 years ago had an average of $10,000 worth of debt. Perhaps the most telling sign of the higher cost of education, is that chemists with terminal bachelor's degrees had an average of $2,000 more debt than chemists with graduate degrees.

10 MEDIAN CUMULATIVE EDUCATIONAL DEBT AT HIGHEST DEGREE BY SEX, RACE AND YEARS SINCE BS ($ THOUSANDS)

		MEDIAN DEBT
	ALL	$11.0
SEX	MEN	$11.0
	WOMEN	12.0
RACE	ASIAN	$10.0
	BLACK	15.0
	HISPANIC	10.0
	WHITE	11.0
	OTHER	20.0
YEARS SINCE BS	UNDER 5	$18.0
	5–9	13.0
	10–14	10.0
	15–19	10.0
DEGREE	BACHELOR'S	$12.0
	MASTER'S	10.0
	DOCTORATE	10.0

SATISFACTION

Few young chemists consider their education to be exclusively a pragmatic goal – 6.9%. Most contend that it is at least "somewhat a goal in itself" – 57.4%. Men are slightly more motivated by pragmatic concerns than are women. Black and Hispanic are slightly less motivated by pragmatic concerns than are other races. And chemists with terminal master's degrees are more pragmatically motivated than are other chemists.

Overall, young chemists are pleased with their educational experiences. Over 80% of chemists are "very satisfied" or "satisfied" with their education. Women are slightly less satisfied with their education than are men – 8.7% of women and 6.3% of men are "dissatisfied" or "very dissatisfied." Variation by race is minimal. One notable exception is that blacks are the most dissatisfied with education – 13.2% are "dissatisfied" or "very dissatisfied" compared with 7.2% of whites.

Satisfaction with education varies by degree. Chemists with doctorates are the most satisfied with their education. Almost 40% of chemists with doctorates are very satisfied with their educational experience whereas only 22.6% of chemists with master's degrees and 28.3% of chemists with bachelor's degrees are very satisfied. Chemists with terminal master's degrees are the least satisfied with their education. Just over 13.4% of chemists with master's degrees are "dissatisfied" or "very dissatisfied" with their education – compared with 6.3% of doctorates and 5.1% of bachelor's.

11 REASON FOR CHOOSING HIGHEST DEGREE FIELD BY SEX, RACE AND DEGREE

		GOAL IN ITSELF	SOMEWHAT A GOAL IN ITSELF	BOTH EQUALLY	SOMEWHAT PRAGMATIC GOAL	PRAGMATIC GOAL
	ALL	31.5%	25.9%	27.2%	8.5%	6.9%
SEX	MEN	30.3%	25.6%	28.1%	8.9%	7.1%
	WOMEN	33.1	27.0	25.5	7.8	6.6
RACE	ASIAN	35.5%	22.3%	29.5%	7.8%	5.0%
	BLACK	42.2	18.1	31.3	6.0	2.4
	HISPANIC	44.4	24.6	22.5	4.2	4.2
	WHITE	30.0	26.9	26.8	8.9	7.3
	OTHER	28.6	24.7	28.6	7.8	10.4
DEGREE	BACHELOR'S	31.9%	22.0%	30.6%	7.6%	7.9%
	MASTER'S	24.2	27.5	29.2	10.5	8.6
	DOCTORATE	33.4	27.3	25.1	8.2	5.9

12 SATISFACTION WITH HIGHEST DEGREE BY SEX, RACE AND DEGREE

		VERY SATISFIED	SATISFIED	NEITHER	DISSATISFIED	VERY DISSATISFIED
	ALL	33.5%	49.4%	9.9%	5.8%	1.4%
SEX	WOMEN	28.1%	52.1%	11.2%	7.3%	1.4%
	MEN	36.7	47.9	9.1	4.9	1.4
RACE	ASIAN	32.1%	51.0%	10.7%	5.5%	0.8%
	BLACK	25.3	42.2	19.3	10.8	2.4
	HISPANIC	36.9	46.1	12.8	4.3	—
	WHITE	33.9	49.6	9.3	5.7	1.5
	OTHER	33.8	45.5	11.7	6.5	2.6
DEGREE	BACHELOR'S	28.3%	54.5%	12.2%	4.1%	1.0%
	MASTER'S	22.6	51.3	12.7	10.3	3.1
	DOCTORATE	39.2	46.5	8.0	5.2	1.1

EMPLOYMENT

Generally, the employment situation of young chemists is excellent. Only 1.1% of chemists under 40 are unemployed and seeking employment. Chemists employed full-time – permanent, temporary and self-employed – account for 92.5% of the chemical workforce under 40. Another 4.3% of the workforce – 7.3% of those with doctorates – consists of postdoctoral fellows, which is three times larger than the proportion of postdoctoral fellows among chemists of all ages.

Employment is strongest in industry where 96.0% of the workforce is employed full-time in permanent positions and only 1% is unemployed. Academics and government continue to be weaker sectors with only 74.5% and 80.1%, respectively, of chemists in full-time, permanent positions. Even accounting for the nearly 15% of academics and 10% of government employees with postdoctoral fellowships, both sectors have considerably higher levels of temporary and part-time employment – almost 10% compared with 2.5% in industry.

Despite the healthy employment status of young chemists, there is some notable variation among men and women. Women hold fewer full-time positions than men – 86.5% of women compared with 91% of men. This partly reflects the higher level of part-time employment among women. Women are five times more likely than men to have part-time employment. It also reflects a higher unemployment rate for women – 1.6% versus 0.8% for men.

Variation among racial groups is minimal. However, some subtle trends are present. Most notably, black chemists hold more part-time positions and fewer postdoctoral fellowships than chemists of other races. Also, Hispanics and "other" races experience higher levels of unemployment than whites – however, blacks and Asians do not.

13 EMPLOYMENT STATUS OF CHEMISTS UNDER AGE 40 BY SEX, RACE, HIGHEST DEGREE AND EMPLOYMENT SECTOR

		FULL-TIME	FULL-TIME TEMPORARY	PART-TIME	POST-DOC	SELF-EMPLOYED	UNEMPLOYED
	ALL	89.4%	2.5%	2.1%	4.3%	0.6%	1.1%
SEX	MEN	91.0%	2.3%	0.8%	4.5%	0.5%	0.8%
SEX	WOMEN	86.7	2.5	4.5	4.1	0.8	1.6
RACE	ASIAN	82.7%	3.4%	1.1%	10.8%	0.6%	1.3%
RACE	BLACK	88.0	2.4	6.0	2.4	—	1.2
RACE	HISPANIC	85.3	3.5	2.1	5.6	1.4	2.1
RACE	WHITE	79.5	3.8	1.3	11.5	1.3	2.6
RACE	OTHER	90.9	2.2	2.2	3.2	0.6	0.9
HIGHEST DEGREE	BACHELOR'S	96.6%	2.5%	2.1%	—	0.4%	1.3%
HIGHEST DEGREE	MASTER'S	94.6	0.5	2.7	—	0.7	1.5
HIGHEST DEGREE	DOCTORATE	85.9	3.0	2.0	7.6%	0.6	0.9
EMPLOYMENT SECTOR	INDUSTRY	96.0%	1.0%	1.5%	0.5%	0.1%	1.0%
EMPLOYMENT SECTOR	ACADEMICS	74.5	5.7	3.9	14.9	—	1.1
EMPLOYMENT SECTOR	GOVERNMENT	80.1	7.9	1.7	10.0	—	0.4
EMPLOYMENT SECTOR	OTHER NON-ACADEMIC	76.5	2.1	4.3	1.6	11.8	3.7

14 CHEMISTS' PREFERRED WORK SCHEDULE BY SEX, RACE, AGE AND HIGHEST DEGREE

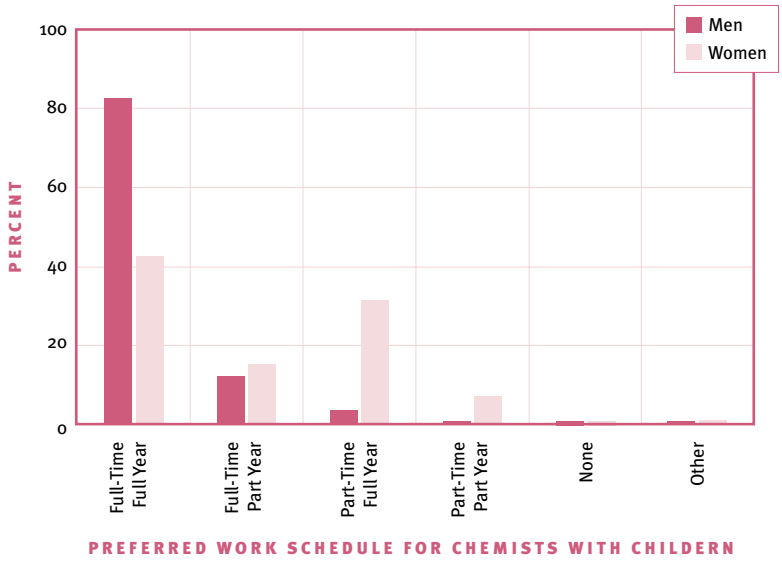
		FULL-TIME FULL YEAR	FULL-TIME PART OF YEAR	PART-TIME FULL YEAR	PART-TIME PART OF YEAR	NONE	OTHER
	ALL	72.0%	15.4%	8.6%	2.1%	0.8%	1.0%
SEX	MEN	80.5%	13.7%	3.0%	1.1%	0.8%	0.9%
	WOMEN	56.8	18.7	18.3	3.9	0.9	1.3
RACE	ASIAN	78.5%	10.5%	8.0%	2.3%	0.6%	0.2%
	BLACK	68.3	26.8	3.7	1.2	—	—
	HISPANIC	72.0	16.8	6.3	2.8	2.1	—
	WHITE	71.2	15.8	9.0	2.1	0.9	1.1
	OTHER	67.9	16.7	7.7	2.6	—	5.1
AGE	UNDER 25	75.2%	15.4%	6.8%	1.7%	—	0.9%
	25–29	74.9	15.5	6.2	1.1	1.4%	0.9
	30–34	72.7	14.5	9.3	1.9	0.5	1.1
	35–39	70.0	16.4	8.9	2.7	0.9	1.0
HIGHEST DEGREE	BACHELOR'S	71.0%	14.0%	10.9%	1.9%	1.3%	0.9%
	MASTER'S	69.3	15.0	10.6	3.1	0.4	1.6
	DOCTORATE	73.3	16.2	6.9	1.9	0.7	0.9

Some of the variation in employment status reflects the differing preferences of chemists. Most chemists – 72% – prefer full-time, year-round employment. However, a significant proportion prefer full-time work part of the year – 15.4%. And another 8.6% prefer part-time, year-round work. Desire for full-time employment declines with each successive age group. Of chemists under 30, 75% desire full-time employment. However, only 70% of chemists 35–39 desire full-time employment. Chemists in this age range prefer part-time or full-time (part of the year) employment more than their younger colleagues.

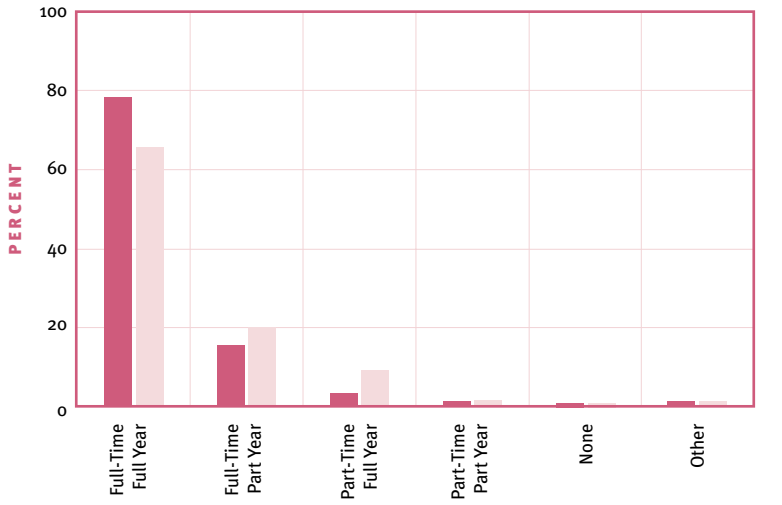
Among racial groups, Asians prefer full-time, year-round employment more than other races. Black chemists are more likely than other chemists to prefer full-time employment part of the year.

The largest difference in work preferences is between men and women. Women are much less likely to prefer full-time, year-round employment than are men – 56.8% of women compared with 80.5% of men. Over one-fifth of women chemists prefer part-time work. This partly explains why part-time employment is more common among women than men: women are six times more likely than men to desire part-time work.

G6 PREFERRED WORK SCHEDULE FOR CHEMISTS WITH AND WITHOUT CHILDREN BY SEX



PREFERRED WORK SCHEDULE FOR CHEMISTS WITH CHILDERN



PREFERRED WORK SCHEDULE FOR CHEMISTS WITHOUT CHILDERN

However, these patterns of employment also reflect the sex-specific nature of family responsibility. Sex differences in work preference are much greater among chemists with children than among chemists without children – regardless of marital status. Among chemists with children, almost twice as many men than women prefer full-time, year- round work – 42.5% of women compared with 82.3% of men. Most of this difference reflects women's desire for part-time, year-round work – 32%. The sex difference among chemists without children is much less pronounced. Almost 80% of men and 65.8% of women prefer full-time work. Women without children also desire more part-time work than their male counterparts but not to the same extent as women with children. Instead, they are more interested in working full-time part of the year. Interestingly, unlike women's work preferences, men's desire for full-time work increases with fatherhood rather than declines – 82.3% of men with children compared with 78.7% of men without children.

EMPLOYMENT SECTOR

Industry is the largest employer of chemists under 40. Just over two-thirds of the chemical workforce under 40 is employed in industry. Almost one quarter of the workforce is employed in academics and 5.6% of the workforce is employed in government. Women are slightly less likely to be employed in industry and more likely to be in academics than are men – 65.3% versus 68.7% in industry and 24.4% versus 21.9% in academics.

Among racial groups, Asians are over-represented in industry and slightly under-represented in academics – 71.8% and 21.6%, respectively. Black chemists are over-represented in academics and under-represented in industry – 27.7% in academics and 63.9% in industry.

WORK FUNCTION

Almost 50% of young chemists work in research and development – 32.6% in applied and 16.3% in basic. Another fifth of chemists work in analytical services or production/quality control. And 14% are teachers/trainers and 7% are managers – general and R&D.

There are some notable sex differences. Women tend to be concentrated working in the analytical and teaching occupations. More women than men are in analytical services and production/quality control – 21% of women compared with 17% of men. Similarly, teaching/training accounts for a higher percentage of women, 17%, than of the men, 12%. At the same time, women are less concentrated in research and management areas. Research accounts for 53% of men and only 42% of women and management accounts for 7.5% of the men and 6.2% of the women.

15 EMPLOYMENT SECTOR OF CHEMISTS BY SEX, RACE AND HIGHEST DEGREE

		INDUSTRY	ACADEMIC	GOVERNMENT	OTHER NON-ACADEMIC
	ALL	67.4%	22.7%	5.6%	4.3%
SEX	MEN	68.7%	21.9%	5.4%	4.1%
	WOMEN	65.3	24.4	5.8	4.6
RACE	ASIAN	71.8%	21.6%	3.8%	2.7%
	BLACK	63.9	27.7	6.0	2.4
	HISPANIC	62.7	23.9	8.5	4.9
	WHITE	67.3	22.8	5.5	4.4
	OTHER	53.8	24.4	12.8	9.0
HIGHEST DEGREE	BACHELOR'S	83.0%	5.0%	5.5%	6.2%
	MASTER'S	77.2	10.3	6.1	6.4
	DOCTORATE	57.1	34.7	5.4	2.8

16 SEX OF CHEMISTS BY WORK FUNCTION

WORK FUNCTION	ALL	MEN	WOMEN
ANALYTICAL SERVICES	12.1%	10.7%	14.5%
CHEMISTRY INFORMATION	0.5	0.4	0.6
COMPUTER PROGRAMMING	1.1	1.2	0.8
CONSULTING	2.0	2.1	2.0
FORENSIC ANALYSIS	0.7	0.6	0.9
GENERAL MANAGEMENT	2.8	2.9	2.7
HEALTH AND SAFETY	2.0	1.2	3.3
MARKETING	2.6	2.8	2.2
PATENTS/LICENSING	0.8	0.7	0.9
PRODUCTION/ QUALITY CONTROL	5.4	5.0	6.1
R&D APPLIED RESEARCH	32.6	35.3	28.2
R&D BASIC RESEARCH	16.3	17.8	13.4
R&D MANAGEMENT	4.3	4.6	3.5
TEACHING	14.0	12.3	17.3
OTHER	2.8	2.4	3.5

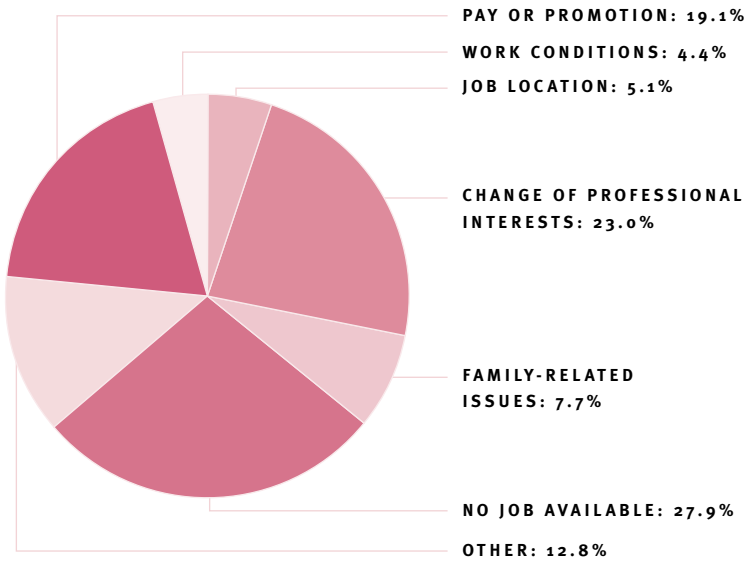
WORK OUTSIDE OF HIGHEST DEGREE FIELD AND CONSULTING

One fifth of chemists under 40 worked outside of their highest degree field at some point in their careers. Slightly more women, 21.5%, than men, 19.5%, worked in a field different from their highest degree. Blacks and Hispanics were more likely than white chemists to have worked outside their field – 30% of black and Hispanic chemists versus 20% of white chemists. Young Asian chemists were less likely than chemists of other races to have worked outside their field – 14.1%. In terms of education, chemists with terminal bachelor's degrees were twice as likely as chemists with doctorates to have worked outside their field.

Most young chemists worked outside their degree field because of job-related concerns. The most important of these concerns is the lack of jobs. Just over 27% of chemists who worked outside their field, did so because they could not find a job in their field. An additional 19% worked outside their field because of poor pay or promotion opportunities and another 10% because of work conditions or job location. However, not all of those working outside their field did so because of poor job opportunities. Almost one quarter of these chemists worked outside their field because of a change in their interests. And 7.7% did so because of family-related concerns.

Similar to the chemical workforce as a whole, a relatively small proportion of chemists under 40 do consulting, 9.9% – compared with 11% of all chemists. In this case there is a real sex difference. Men are more likely than women to work as consultants – 11.4% versus 7.2%. Racial differences are also apparent. More white chemists are consultants than are chemists of other races, with the exception of black chemists who consult as frequently as their white counterparts.

G7 MOST IMPORTANT REASONS WHY CHEMISTS WORK OUTSIDE DEGREE FIELD



17 CONSULTING AND WORK OUTSIDE OF FIELD BY SEX, RACE AND HIGHEST DEGREE

		% WHO WORKED OUTSIDE FIELD	% WHO DO CONSULTING
	ALL	20.2%	9.9%
SEX	MEN	19.5%	11.4%
	WOMEN	21.5	7.2
RACE	ASIAN	14.1%	6.3%
	BLACK	30.1	10.8
	HISPANIC	30.1	7.7
	WHITE	20.3	10.5
	OTHER	25.6	7.7
HIGHEST DEGREE	BACHELOR'S	28.7%	8.2%
	MASTER'S	24.9	10.0
	DOCTORATE	14.8	10.6

SALARIES AND BENEFITS

The salaries in this report are base pay for chemists with full-time, permanent employment as of March 1, 2001. All extra professional income is excluded – bonuses, consulting fees and so forth. Salaries of self-employed and temporary, full-time workers are excluded, as are salaries of part-time employees. All salaries are reported as medians – to adjust for the skewed nature of the income distribution.

18 MEDIAN SALARIES OF CHEMISTS BY HIGHEST DEGREE BY SEX, RACE AND EMPLOYMENT SECTOR ($ THOUSANDS)

		HIGHEST DEGREE			
		BS	MS	PHD	ALL
	ALL	$48.3	$56.5	$72.5	$60.5
SEX	MEN	$50.0	$59.0	$73.9	$65.0
SEX	WOMEN	47.0	54.0	70.0	55.0
RACE	ASIAN	$52.9	$59.7	$75.9	$72.0
RACE	BLACK	43.7	52.0	58.5	49.0
RACE	HISPANIC	45.5	50.5	69.9	53.0
RACE	WHITE	48.4	56.6	72.0	60.0
RACE	OTHER	50.0	62.7	74.7	65.5
EMPLOYMENT SECTOR	INDUSTRY	$50.0	$59.5	$80.0	$67.6
EMPLOYMENT SECTOR	ACADEMIC	32.0	36.9	48.0	46.0
EMPLOYMENT SECTOR	GOVERNMENT	43.0	51.0	70.0	60.0
EMPLOYMENT SECTOR	OTHER NON-ACADEMIC	46.5	52.0	83.0	54.0

NOTE: Median base salaries from primary employment for those with full-time permanent jobs

The pattern of median salaries for chemists under 40 is similar to that of all ACS chemists. Young chemists in industry, like their older peers, earn more than chemists in government and academics. Industrial chemists earn an average of $67,600, compared with $60,000 in government, $54,000 in other non-academic occupations and only $46,000 in academics. On average, young chemists in industry earn almost 90% of the median salary for all ACS chemists in industry. For government, they earn 80% and for doctorates in academics they earn 76%. This pattern remains stable even after adjusting for differences in education and experience.

There is notable racial and sex variation in salaries. Overall, black and Hispanic chemists earn less than white chemists – $49,000 and $53,000, respectively, versus $60,000. Black chemists earn, on average, 82% of the median salary for white chemists. For Hispanics, it is 88%. Educational attainment accounts for much of the observed difference between races. For instance, black chemists with BS or MS degrees earn, on average, over 90% of the median salary for whites with comparable education – though, at the doctoral level blacks only earn 82%. Adjusting for employment sector brings the average salary of black chemists with doctorates up to 90% of that for comparable white chemists. And for Hispanics it brings it up to 95%. Level of experience, work function and a host of other factors account for some of the remaining difference.

Nonetheless, it appears that some racial groups, especially blacks, still have notably lower salaries, even after adjusting for relevant factors.

Young chemists working in R&D management and patents and licensing have the highest salaries. The median salary for R&D management is $93,000. For applied R&D it is $70,900 and for basic R&D it is $65,000. Chemists working in patents and licensing earn, on average, $85,300. The lowest salaries are found in teaching, forensics and analytical services – $43,200, $47,000 and $51,800, respectively. An examination of the percentage of women in each work field shows that women are over-represented in the lower paying jobs – teaching, forensics, analytical services and so forth – and under-represented in the higher paying jobs – R&D management, patents and licensing.

Women also appear to earn significantly less than men. The average salary for men is $65,000 and for women it is only $55,000 – just 85% of men's salaries. However, much of this difference is explained by education – as were differences among races. Overall, men have higher levels of education. When this is taken into account the gap narrows substantially. Among doctorates, women's salaries are 96% of men's salaries. For master's degrees, women earn 92% of men's salaries and for bachelor's they earn 94%. Another part of the explanation is that women are disproportionately concentrated in the lower paying fields. Differences in experience also contribute to the explanation. Taking these things into consideration, there are still real differences in men's and women's salaries. Similar to the chemical workforce as a whole, young women chemists earn 4–8% less than their male counterparts.

19 **MEDIAN SALARIES BY SEX AND WORK FUNCTION ($ THOUSANDS)**

WORK FUNCTION	ALL	MEN	WOMEN	% OF WOMEN IN FUNCTION
R&D MANAGEMENT	$93.0	$95.8	$86.0	30%
PATENTS & LICENSING	85.3	—	—	42
APPLIED R&D	70.9	72.0	66.0	31
GENERAL MANAGEMENT	69.0	70.0	56.0	35
MARKETING	65.5	69.0	65.5	31
BASIC R&D	65.0	67.0	60.0	30
COMPUTER PROGRAMMING	62.3	61.5	—	26
CONSULTING	62.0	68.0	48.0	35
HEALTH & SAFETY	58.3	60.3	57.0	60
PRODUCTION/ QUALITY CONTROL	54.0	54.1	52.9	41
ANALYTICAL SERVICES	51.8	55.0	49.0	43
FORENSIC ANALYSIS	47.0	—	—	45
TEACHING/TRAINING	43.2	43.5	42.0	44

NOTE: Median base salaries from primary employment for those with full-time permanent jobs

There are signs, however, that women's progress toward closing the sex gap has slowed or even reversed in recent years. The largest gap between men's and women's earnings is among chemists who obtained their BS 15–19 years ago – which, in industry, ranges from 87% for bachelor's to 95% for doctorates. The gap narrows to its smallest size among those who graduated 10–14 years ago. Women in this category earn 97–102% of their male counterpart's median salary – 102% for doctorates, 97% for master's and 100% for bachelor's. The difference between sexes then increases among those who graduated 5–9 years ago – 97% for doctorates, 95% for master's and 96% bachelor's. And increases even further among

20 MEDIAN SALARIES BY YEARS SINCE BACHELOR'S BY HIGHEST DEGREE, SEX AND EMPLOYMENT SECTOR ($ THOUSANDS)

HIGHEST DEGREE	ALL RESPONDENTS	UNDER 5	5–9	10–14	15–19
BS	MEN	$41.5	$48.0	$55.5	$62.6
	WOMEN	38.5	47.6	55.0	52.5
	ALL	40.0	48.0	55.3	60.0
MS	MEN	–	$53.0	$60.0	$68.8
	WOMEN	–	50.0	57.4	60.0
	ALL	$48.0	52.0	59.7	65.0
PHD	MEN	–	$70.0	$72.0	$80.0
	WOMEN	–	69.7	69.0	72.0
	ALL	–	70.0	72.0	77.0

HIGHEST DEGREE	INDUSTRIAL RESPONDENTS	UNDER 5	5–9	10–14	15–19
BS	MEN	$42.5	$50.0	$56.4	$62.1
	WOMEN	40.0	48.0	56.0	54.0
	ALL	41.0	48.9	56.0	60.0
MS	MEN	–	$54.7	$62.0	$71.0
	WOMEN	–	51.8	60.0	66.4
	ALL	–	53.0	61.9	69.5
PHD	MEN	–	$75.0	$78.2	$85.6
	WOMEN	–	72.6	80.0	81.0
	ALL	–	73.0	79.0	85.0

HIGHEST DEGREE	ACADEMIC RESPONDENTS	UNDER 5	5–9	10–14	15–19
PHD	MEN	–	$45.0	$48.3	$52.0
	WOMEN	–	42.0	45.0	49.0
	ALL	–	44.4	47.0	51.0

NOTE: Median base salaries from primary employment for those with full-time permanent jobs

those who graduated less than five years ago – to 94% for women with bachelor's degrees.

In academics, the sex gap varies little by the number of years since their BS. Women in academics appear to make about 6–7% less than men, on average, regardless of how many years ago they graduated. However, this income gap partly reflects the fact that women are more likely to hold lower academic ranks and to be contract employees than are men. When academic rank, experience and other factors are considered the difference drops to 3–4%.

PENSIONS

Almost all young chemists have pensions plans – 99.2%. Although a variety of plans are available to most chemists, different types of pension plans are predominant in each employment sector. Salary reduction plans are the most important plan for the private sector. Over 81% of industrial chemists and 68.8% of chemists in other non-academic jobs rely on salary reduction plans. A sizable number of government and academic workers also have salary reduction plans – 20% of government workers and 13.5% of academics. However, in academics and government employer pension plans are most common.

21 **CHEMISTS' EMPLOYMENT SECTOR BY TYPE OF PRIMARY PENSION PLAN**

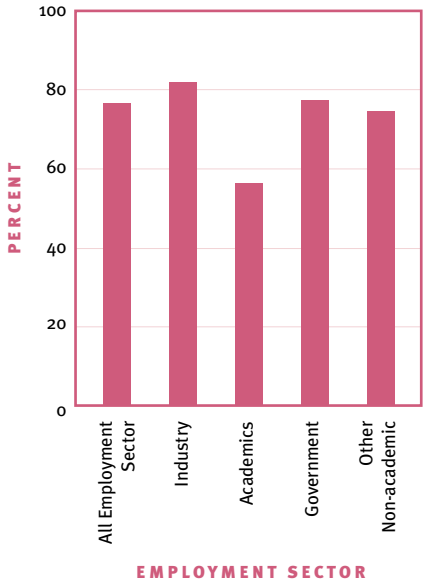
TYPE OF PENSION	ALL	INDUSTRY	ACADEMIC	GOVERNMENT	OTHER NON-ACADEMIC
EMPLOYER PENSION	25.2%	8.7%	81.4%	63.4%	15.2%
SALARY REDUCTION: PROFIT SEEKING	63.0	81.0	3.1	20.0	68.8
SALARY REDUCTION: NON-PROFIT	3.4	0.6	13.5	9.1	1.6
IRA'S	1.5	1.5	1.1	1.7	3.2
EMPLOYEE STOCK OWNERSHIP	6.0	7.4	0.2	4.6	9.6
NO PLAN	0.8	0.7	0.8	1.1	1.6

NOTE: Primary pensions for those with full-time permanent jobs

EDUCATIONAL BENEFITS

Surprisingly, over three-quarters of chemists employed full-time have educational benefits at work. Industry provides the greatest of opportunity for continuing education. Almost 82% of chemists employed in industry have educational benefits. For government, 77.2% of chemists have benefits and for other non-academic jobs, 74.1% have benefits. Somewhat ironically, academics have the least access to educational benefits – 56.2%.

G8 **CHEMISTS' EMPLOYMENT SECTOR BY PERCENT WITH EDUCATIONAL BENEFITS**



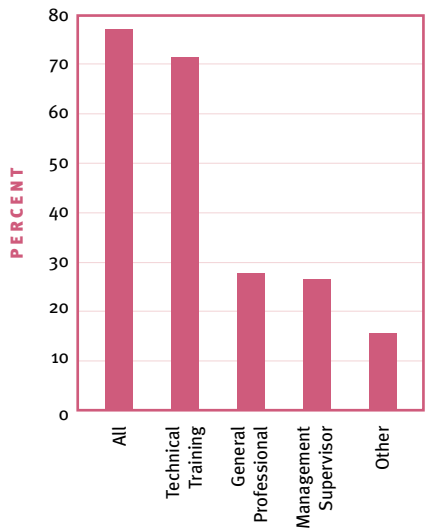
NOTE: Educational benefits for those with full-time permanent jobs

WORK ISSUES

TRAINING

Overall, young chemists highly rate their training (informal and formal) for important work activities. Graph 9 on the next page shows chemists' ratings of the importance of specific work activities and the quality of academic training they receive for those activities. There is a clear correlation between the importance of a work activity and the quality of training for that activity: chemists receive good training for important work activities and poorer training for less important work activities.

G10 ATTENDANCE AT WORK-RELATED TRAINING



Critical thinking, analyzing data, knowledge of discipline, oral presentation and writing top the list of most important work skills. Over 85% of chemists agree that these are "very important" or "important" work activities for chemists. They also overwhelmingly agree that academic training for these activities is very good – between 72% and 91% of chemists agree training is "very good" or "good".

At the other end of the spectrum, respondents say that grant writing, foreign languages and classroom teaching are not very important and that the quality of training for these activities isn't particularly good. Only 10–33% of chemists rate these items as "very important" or "important" and only 20–42% of the chemists rate their training in these activities as "very good" or "good."

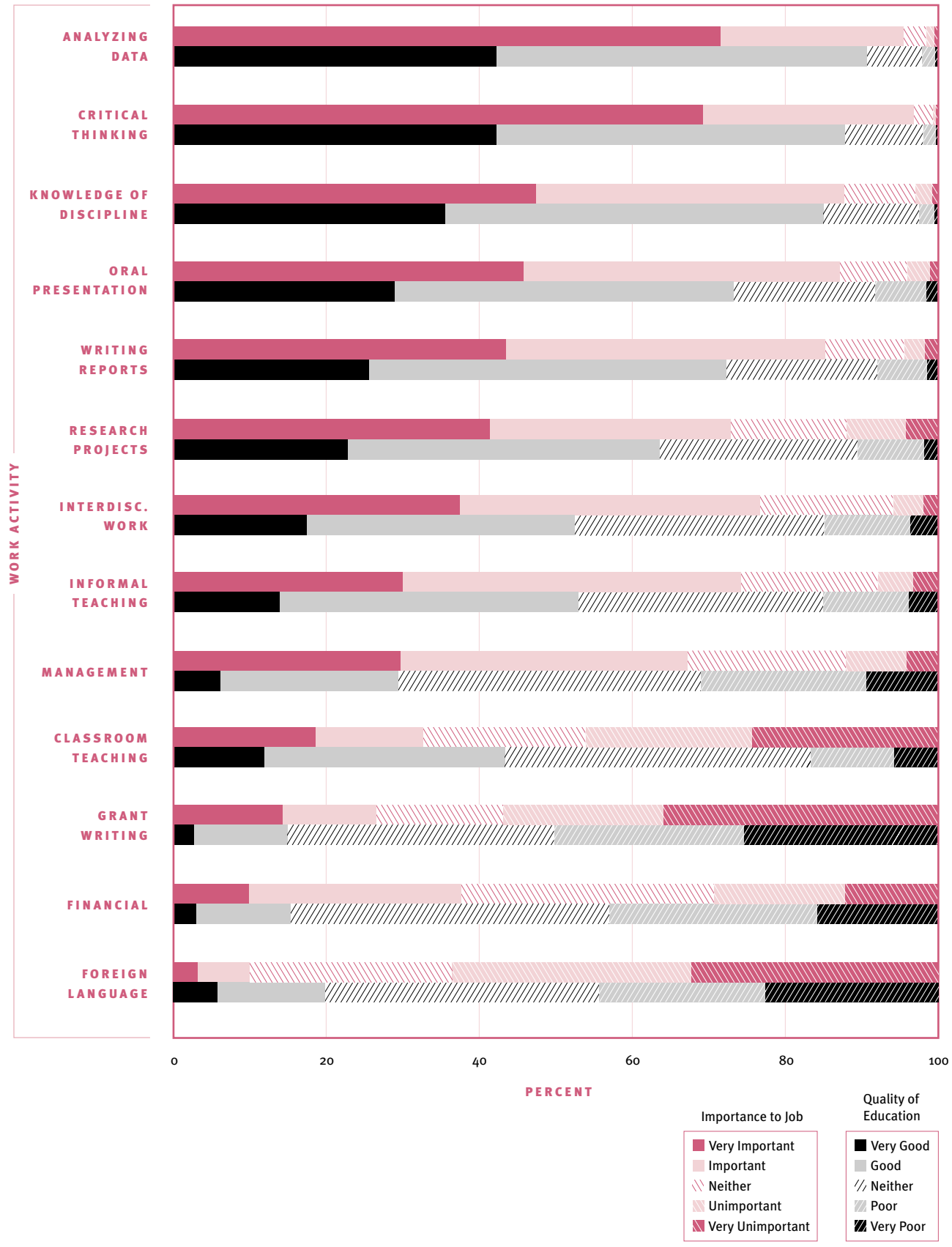
One notable exception to this general pattern is management training. Although 67.3% of chemists rate management activities as "very important" or "important," only 29.5% rate the quality of their management training as "very good" or "good."

Three-quarters of young chemists attend work-related workshops, seminars or other forms of training – most on company time. Of those who attend workshops, 71.4% participate in technical training, 27.7% in general professional training, 26.6% in management training and 15.5% in other forms of training.

Of all forms of training, management skills may be the most important to young chemists. These skills often provide the basis for career advancement and promotion – not to mention that managerial positions are among the highest paid positions in chemistry. Graph 11 shows management training by sex and race. Women are less likely than men to participate in management training – 22.6% of women compared with 29.4% of men. This is especially significant because women chemists under 40 are also under-represented among supervisors – 49.1% of women versus 59.2% of men.

The pattern of management training varies more among racial groups. Both Asian

G9 QUALITY OF HIGHEST DEGREE EDUCATION AND IMPORTANCE TO JOB BY WORK ACTIVITY



G11 ATTENDANCE OF MANAGEMENT/SUPERVISOR TRAINING BY SEX AND RACE

and Hispanic chemists are as likely as white chemists to participate in management training. Asians also are proportionately represented as supervisors in the chemical workforce. Hispanics, however, are 10% less likely than their white counterparts to be supervisors. For black chemists, it is another story. Not only are black chemists under-represented in management training but they are also significantly under-represented as supervisors. Only 42% of black chemists supervise others and only 15% participate in management training – compared with 55% and 27%, respectively, of whites.

ATTITUDES ABOUT CURRENT POSITION

Young chemists are generally positive about their employment situations. Most say they were academically well prepared when they started their current position and that their current position is commensurate with their education – 77.3% and 72.7%, respectively. An even larger proportion say their job is professionally challenging – 84.8%. A majority, though significantly fewer, say their current job is what they expected it would be when they accepted it – 61.5%.

This optimism is tempered somewhat by attitudes toward job advancement. Just under half of the young chemists think their position is a step toward a better position – 49.4%. And 44.1% say they are likely to leave their current position in the next five years, though only 20% say they are presently looking for another position. Overall, women are a bit less enthusiastic about their employment prospects than are men.

22 SEX OF CHEMISTS BY ATTITUDES ABOUT CURRENT POSITION

ATTITUDES	% WHO "AGREE" OR "STRONGLY AGREE" ALL	MEN	WOMEN
ACADEMICALLY PREPARED	77.3%	79.3%	73.9%
COMMENSURATE WITH EDUCATION	72.7	73.3	71.4
IS WHAT I EXPECTED	61.5	64.5	56.9
PROFESSIONALLY CHALLENGING	84.8	86.1	82.7
A STEP TOWARD A BETTER POSITION	49.4	50.3	47.9
LOOKING FOR ANOTHER POSITION	20.8	20.9	20.6
LIKELY TO LEAVE CURRENT POSITION IN NEXT FIVE YEARS	44.1	43.2	46.2

Despite their general optimism, most young chemists say they would do some things differently if they could begin their career again. Only 27.7% of chemists under 40 say they would make no changes in their career. Of the changes chemists say they would make, choosing a different science is mentioned most frequently – 21.8%. Other common changes include choosing a different school, completing a higher degree and choosing a different academic advisor – 17.3%, 16.7%, and 14.9%, respectively. With the exception of completing a higher degree, sex differences are generally small. Men are more likely than women to say they would complete a higher degree if they could start their career over again – 15.7% versus 9.6%.

Very few young chemists expect to lose their job in the next five years – only 8.7%. Downsizing, business closure and funding reduction top the list of most likely culprits for loss of jobs. However, there is predictable variation in the reasons for potential job loss among employment sectors. Industrial chemists fear downsizing and plant closure while academics fear denial of tenure, funding reduction and temporary employment. Chemists working in government are concerned most with funding reduction, temporary employment and downsizing.

23 SEX OF CHEMISTS BY TYPE OF CHANGES IF ONE COULD BEGIN AGAIN

TYPE OF CHANGE IF YOU COULD START OVER	ALL	MEN	WOMEN
MAKE NO CHANGES	27.7%	28.4%	26.5%
LESS TIME FINISHING DEGREE	13.4	15.7	9.6
COMPLETE HIGHER DEGREE	16.7	15.4	19.0
END WITH LESSER DEGREE	3.9	3.7	4.2
CHOOSE DIFFERENT CHEM SPECIALTY	12.0	11.4	13.1
CHOOSE DIFFERENT SCIENCE	21.8	21.6	22.1
NOT PURSUE SCIENCE DEGREE	7.4	7.5	7.1
CHOOSE DIFFERENT ADVISOR	14.9	14.4	15.8
CHOOSE DIFFERENT SCHOOL	17.3	17.4	17.2
CHOOSE DIFFERENT FIRST POSITION	12.8	12.9	12.9
CHOOSE DIFFERENT CURRENT POSITION	9.1	8.9	9.2
OTHER	7.3	6.6	8.3

24 SEX AND EMPLOYMENT SECTOR OF CHEMISTS BY REASON FOR POTENTIAL JOB LOSS

REASON FOR POTENTIAL JOB LOSS	SEX			SECTOR		
	ALL	MEN	WOMEN	INDUSTRY	ACADEMIC	GOVERNMENT
DOWNSIZING	40%	40%	40%	56%	2%	10%
CLOSURE OF EMPLOYER	11	11	10	13	4	8
LOSS/REDUCTION OF FUNDING	10	9	10	5	18	28
DENIAL OF TENURE	8	9	8	—	36	1
END OF TEMP JOB	4	4	4	1	12	11
GETTING FIRED	4	4	4	4	5	7
UNSPECIFIED REASONS	19	18	20	17	20	23

WORK AND FAMILY

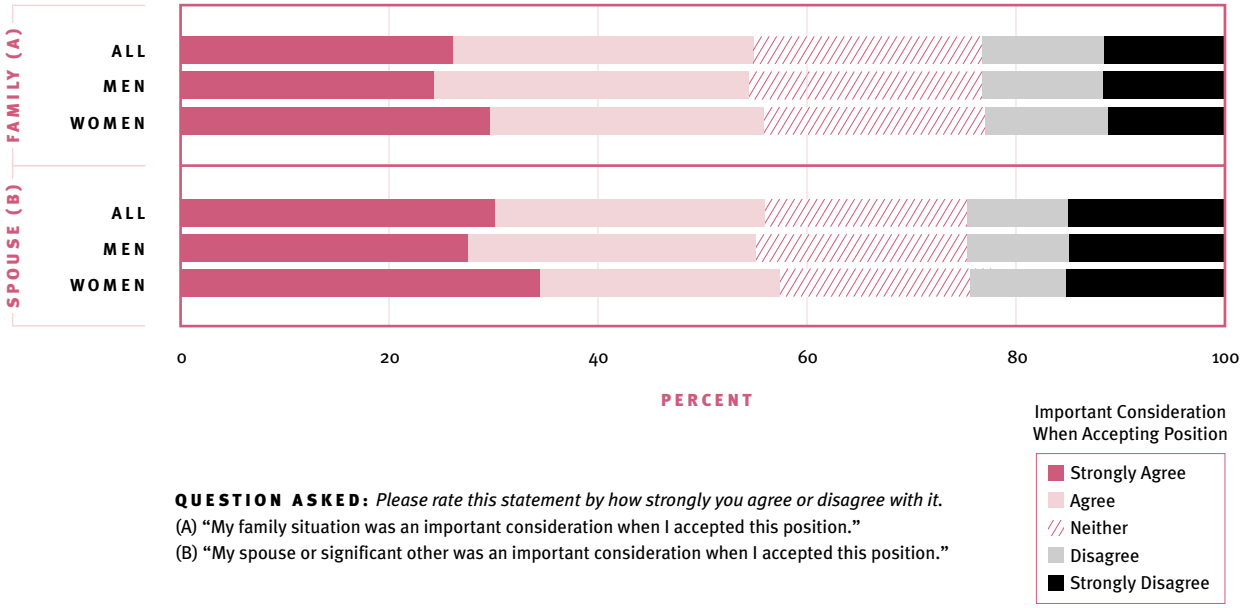
Historically, women have been more likely than men to consider family issues when deciding whether to accept a new job. There are some signs that this trend is changing. Over 55% of men and women "strongly agree" or "agree" that their family and their spouse are important considerations when being hired for a job. Subtle sex differences still remain. Women are slightly more likely than men to "strongly agree" that family and spouse are important considerations – for family, 29.6% versus 24.2% and for spouse, 34.4% versus 27.5%.

Although men and women hold similar views on the influence of family in choosing a job, they differ significantly in their attitudes about the effects of balancing family and other aspects of life with work. Overall, men are more likely than women to say that balancing family and work has no effect on their careers – 33.5% of men compared with 26.9% of women. For both men and women, balancing other aspects of life

25 SEX OF CHEMISTS BY EFFECTS OF BALANCING WORK WITH OTHER ASPECTS OF LIFE ON CAREER

EFFECT ON CAREER	ALL	MEN	WOMEN
NONE	31.1%	33.5%	26.9%
CHOICE OF CAREER GOALS	31.3	30.1	34.3
CHOICE OF CURRENT POSITION	31.0	29.9	33.5
NEGOTIATIONS WITH SUPERVISORS	13.1	11.8	15.6
HOURS WILLING TO WORK	42.1	39.9	47.0

G12 IMPORTANCE OF FAMILY AND SPOUSE TO CHEMISTS' ACCEPTANCE OF POSITION BY FAMILY, SPOUSE AND BY SEX



QUESTION ASKED: *Please rate this statement by how strongly you agree or disagree with it.*
(A) "My family situation was an important consideration when I accepted this position."
(B) "My spouse or significant other was an important consideration when I accepted this position."

with work affects the hours they are willing to work, their choice of position and their career goals. Women, however, are more likely than men to be affected in these ways, especially in the choice of work hours – 47% versus 39.9%.

DISCRIMINATION IN THE WORKPLACE

Similar to the trends in education, there is considerable sex and racial discrimination in the workplace. Over one-third of women chemists experience sex discrimination at work – 3.2% of men report sex discrimination. Almost half of black chemists report racial discrimination on the job – 2.5% of whites report discrimination. Asians and Hispanics experience significant levels of racial discrimination, too – 24.3% of Asians and 15.4% of Hispanics.

Chemists on visas also experience notable discrimination in the workplace. Over one-quarter of immigrants experience discrimination based on their immigration status. The highest level of discrimination is found among chemists on work and other non-residency visas – 28.2%. Another 24.4% of chemists with permanent residency visas also face workplace discrimination.

26 DISCRIMINATION IN THE WORKPLACE BY SEX, RACE AND CITIZENSHIP

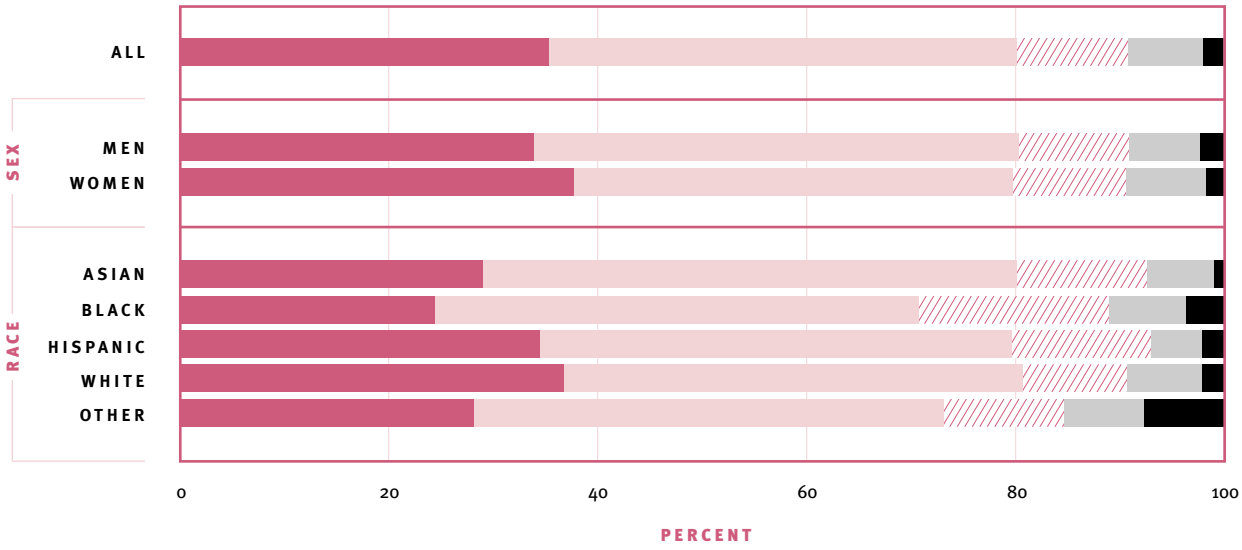
		% EXPERIENCING DISCRIMINATION
SEX	MEN	3.2%
	WOMEN	36.0
RACE	ASIAN	24.3%
	BLACK	48.2
	HISPANIC	15.4
	WHITE	2.5
	OTHER	16.7
CITIZENSHIP	U.S. NATIVE	0.4%
	U.S. NATURALIZED	10.9
	U.S. PERMANENT RESIDENT VISA	24.4
	OTHER VISA	28.2

JOB SATISFACTION

Job satisfaction is very high among young chemists. Three-quarters of chemists "strongly agree" or "agree" that their current position is satisfying. An even greater proportion of young chemists say they are satisfied with the level of self-direction in their current position – 80.1%. And most chemists are satisfied with the progress they are making toward their career goals – 70.5%.

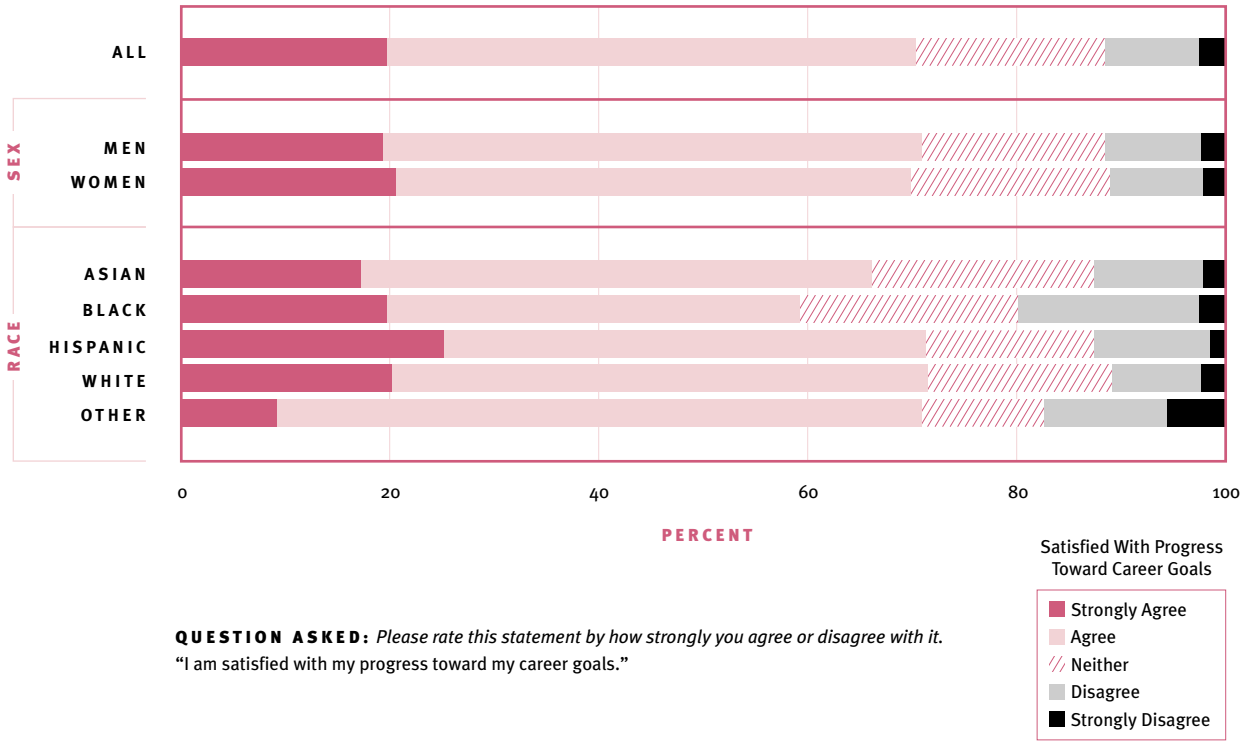
There are notable differences among racial groups. Blacks and Hispanics are less satisfied with their current position than are members of other racial groups – 16% of blacks and 15.4% of Hispanics "strongly disagree" or "disagree" compared with 10.1% of whites. And chemists of all non-white racial groups are less satisfied with their progress toward career goals than are white chemists. Among black chemists, 19.8% "strongly disagree" or "disagree." For Hispanics it is 12.6% and for Asians it is 12.4%.

G13 CHEMISTS' JOB SATISFACTION WITH THE LEVEL OF SELF-DIRECTION VS. SUPERVISION BY SEX AND RACE



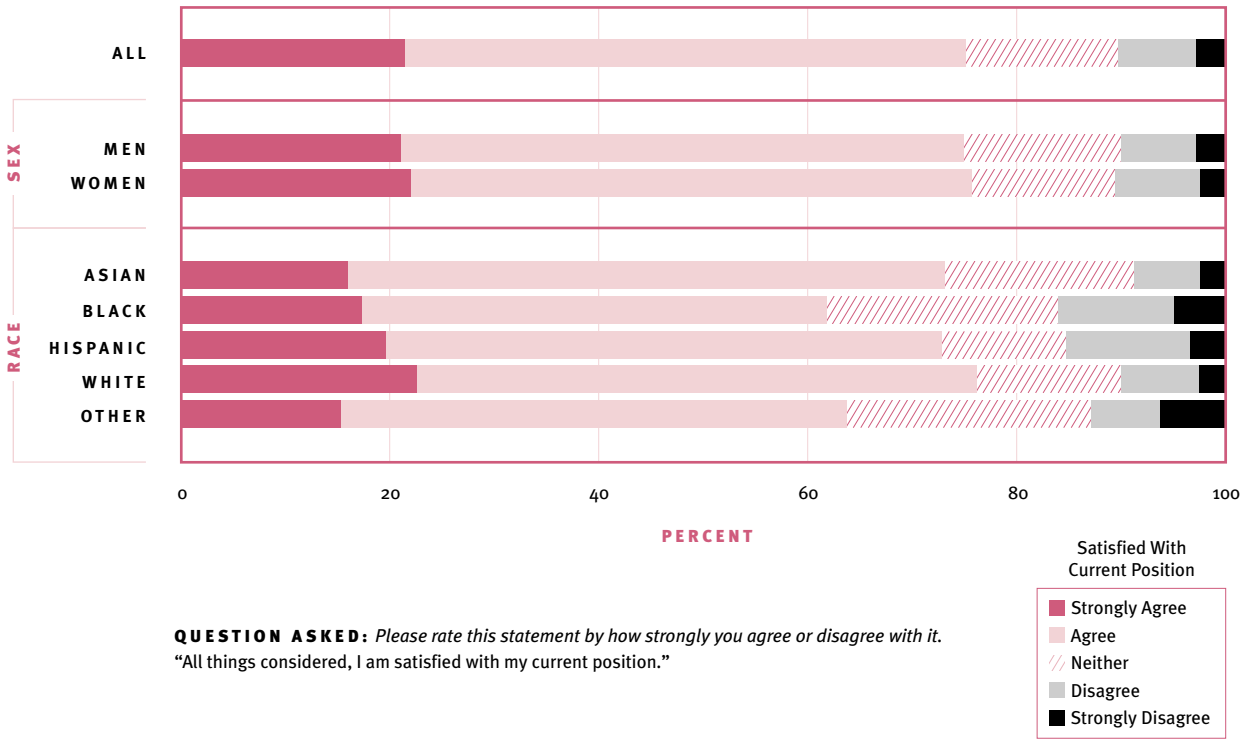
QUESTION ASKED: *Please rate this statement by how strongly you agree or disagree with it.*
"I am satisfied with the level of self-direction versus supervision in my current position."

G14 CHEMISTS' SATISFACTION WITH PROGRESS TOWARDS CAREER GOALS BY SEX AND RACE



QUESTION ASKED: *Please rate this statement by how strongly you agree or disagree with it.*
"I am satisfied with my progress toward my career goals."

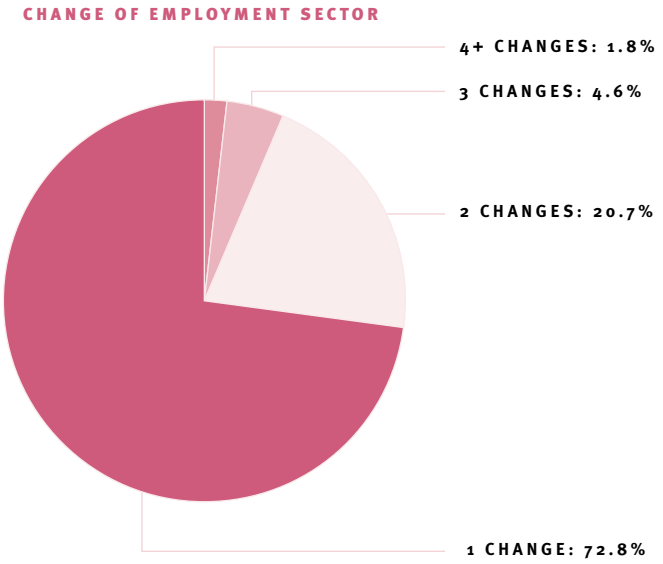
G15 CHEMISTS' SATISFACTION WITH CURRENT POSITION BY SEX AND RACE

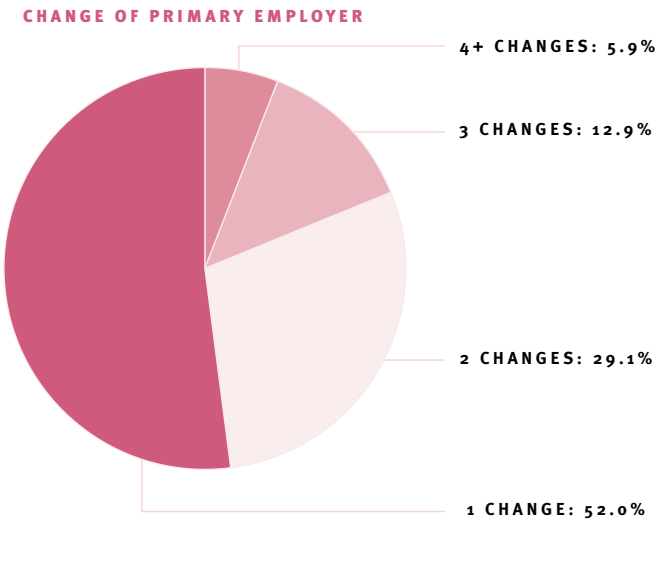


QUESTION ASKED: *Please rate this statement by how strongly you agree or disagree with it.*
"All things considered, I am satisfied with my current position."

CAREER TRANSITIONS

G16 FREQUENCY OF CHANGE WITH EMPLOYMENT SECTOR AND PRIMARY EMPLOYER FOR THOSE WHO HAVE EXPERIENCED CHANGES



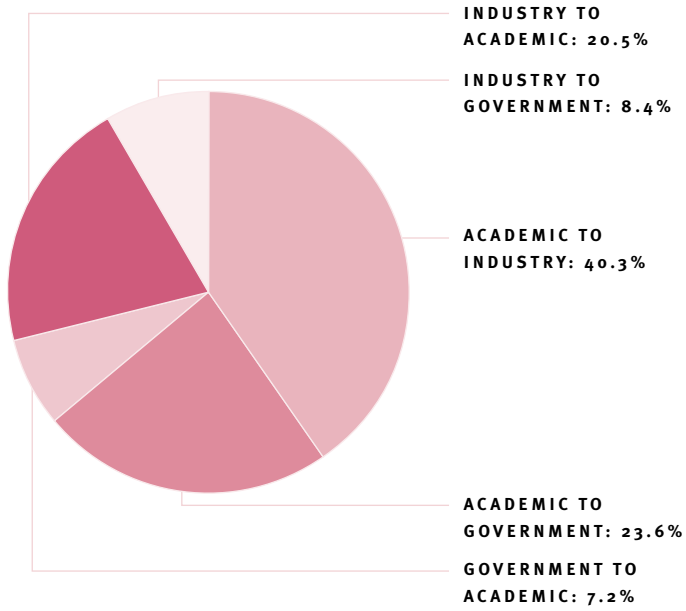


Among chemists under 40, there is a moderate amount of movement between labor markets. Over 60% of young chemists have had more than one primary employer during the early years of their career. On average, they change employers only once. Almost 30% change employers twice and 13% change employers three times. Most employment changes occur in the same sector. Only 27.9% of employment changes are between different sectors. And an overwhelming majority of chemists who change jobs, make only one change of employment sector.

Most movement between sectors occurs between academics and industry. Just over 40% of sector changes involve a move from academics to industry. Another 20.5% of changes are from industry to academics. There is also some movement between academics and government. Approximately 23% of changes are from academics to government and 7.2% are from government to academics. The fewest sector changes are between government and industry. Only 8.4% of changes are from industry to government and no changes are from government to industry.

Chemists' reasons for changing primary employment vary considerably. The major reasons for changes in employment are better pay and promotion, working conditions, and job location – 35.1%, 23.0% and 18.2%, respectively. Changing professional interests and family concerns are also important factors – 12.5% and 13.5%, respectively. The sex differences are subtle but are consistent with the pattern identified throughout this survey: men are more influenced by pay and promotion and women are more concerned with family issues.

G17 EMPLOYMENT SECTOR SWITCHES DURING CAREER



27 SEX OF CHEMISTS BY REASON FOR CHANGING PRIMARY EMPLOYERS

REASON FOR CHANGING EMPLOYERS	ALL	MEN	WOMEN
PAY/PROMOTION	35.1%	38.0%	30.0%
WORK CONDITIONS	23.0	23.8	21.9
JOB LOCATION	18.2	18.6	17.5
CHANGING INTERESTS	12.5	12.6	12.0
FAMILY	13.5	12.7	15.1
RETURN TO SCHOOL	3.7	3.6	3.8
UNEMPLOYMENT	8.0	8.0	8.2
LEFT WORKFORCE	0.4	0.4	0.4
OTHER	8.7	8.3	8.9

A small proportion of chemists under 40 experience a break in employment for six months or more – 12.3%. Women are more likely than men to experience a break in employment – 15.9% or women compared with 9.3% of men. Unemployment is the most common type of hiatus, followed by work outside of profession and leave without pay. Of those involved in a hiatus, 78% have only one.

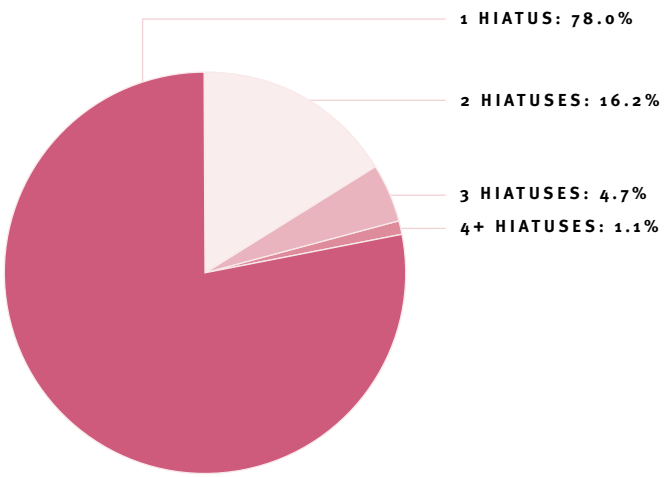
The most common reasons for a break in employment are termination (voluntary and involuntary), moving for a spouse, maternity/childcare and other (unspecified reasons). Women are more likely than men to leave work because of a spouse (moving) or maternity and childcare – 30.1% and 33.7% of women, respectively, versus 10.2% and 2.0% of men. Men, on the other hand, are more likely than women to leave because of involuntary termination – 30.3% of men compared with 16.3% of women – and because of "other" reasons – 34.3% versus 19.5%.

Chemists are almost evenly divided on whether their break from employment had any effect on their career. Under half of chemists say their break had no effect on their career, 36.4% say it hurt their career and 17.4% say it helped their career. Generally, women are a bit more likely to say that their careers were not helped by the break.

28 SEX OF CHEMISTS BY TYPE OF HIATUS IN CAREER (LONGER THAN SIX MONTHS)

TYPE OF HIATUS	ALL	MEN	WOMEN
NONE	87.7%	90.7%	84.1%
UNEMPLOYMENT	7.5	6.5	9.3
WORK OUTSIDE PROFESSION	1.8	1.6	2.3
LEAVE WITHOUT PAY	0.6	0.2	1.4
PAID LEAVE	0.3	0.1	0.7
OTHER	1.4	0.9	2.3

G18 NUMBER OF CAREER HIATUSES FOR THOSE WHO HAVE EXPERIENCED A HIATUS



29 SEX OF CHEMISTS BY REASON FOR HIATUS IN CAREER

REASON FOR HIATUS	ALL	MEN	WOMEN
TERMINATION	22.1%	30.3%	16.3%
QUIT JOB	23.2	26.8	22.8
MATERNITY/CHILDCARE	16.5	2.0	33.7
MOVING FOR SPOUSE	18.7	10.2	30.1
ELDER CARE	1.1	1.2	0.8
PERSONAL/HEALTH	7.3	9.4	5.7
OTHER	25.8	34.3	19.5

30 SEX OF CHEMISTS BY EFFECT OF HIATUS ON CAREER

EFFECT OF HIATUS	ALL	MEN	WOMEN
NO EFFECT	46.5%	45.5%	47.2%
HELPED CAREER	17.4	18.4	15.7
HURT CAREER	36.2	36.1	37.0

APPENDIX: SURVEY QUESTIONNAIRE

RECENT CEPA EMPLOYMENT STUDIES AVAILABLE FROM ACS

- *Current Trends 1998* – A study of employers discussion of trends in chemical employment, with emphasis on the technologies and skills necessary for chemical professionals.
- *Lifetimes in Chemistry 1999–2000* – A report drawn from the 1999 study of ACS members, aged 50 through 69.
- *ChemCensus 2000* – A look at the decade of the 1990s through comparing data from the 1990, 1995, and 2000 ACS censuses of working members.
- *Women Chemists 2000* – A look at the decade of the 1990s through comparing data on women chemists from the 1990, 1995, and 2000 ACS censuses of working members.
- *Industrial Chemists 2000* – A look at the decade of the 1990s through comparing data on industrial chemists from the 1990, 1995, and 2000 ACS censuses of working members.
- *Academic Chemists 2000* – A look at the decade of the 1990s through comparing data on academic chemists from the 1990, 1995, and 2000 ACS censuses of working members.
- *Early Careers of Chemists 2001–2002* – a detailed look at the education and early careers of ACS members under age 40, conducted in 2001.

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