CALTECH'S 1963 ALUMNI SURVEY

IV. *Occupation and Income*

by John R. Weir

Of the 4,615 alumni who completed the survey questionnaire, 52 are retired and 294 are still students, representing 7 percent of the total. All the rest are employed—61 percent of them in industry, 16 percent in education, 12 percent in government, and 6 percent in the military.

Industry

Almost half (46 percent) of the alumni employed by industry are doing research, design, or development work. One-third are in administration, and the remainder (15 percent) are mostly in operations, production, and marketing.

Electrical engineering was the most frequently mentioned field of specialization among those employed in industry. It accounted for 20 percent of the total. Business was next with 16 percent, followed by mechanical engineering (13 percent), aeronautics (10 percent), physics (7 percent), chemical engineering (5 percent), and civil engineering (5 percent). Each of the remaining 37 fields mentioned accounted for less than 5 percent.

Engineer was the most frequently reported position title (17 percent), followed by manager (15 percent), scientist (6 percent), and staff member (6 percent). The titles of president, vice president, and group supervisor each accounted for 5 percent. Director, project leader, and section head each had 4 percent, and chief, group leader, owner, and project supervisor each had 3 percent. There was less than 3 percent in each of the remaining 18 position titles used in the questionnaire.

The table of median income by job function for industry suggests high rewards for getting the product out the door and into the hands of the consumer. Alumni in research and design are at the bottom of the list.

Function	*Median annual earned income*
Administration	$20,000
Marketing	16,000
Production	15,000
Operations	15,000
Consulting	15,000
Development	15,000
Research	14,000
Design	13,000

Education

Caltech alumni employed in the educational sector of the economy are almost evenly distributed between teaching (45 percent) and research (47 percent). Many alumni indicated they are engaged in both, but for purposes of tabulation only their chief function was counted. An additional 7 percent are in administration.

"Education" was also listed as a field of specialization, along with the science, engineering, and other fields. This has led to a certain amount of redundancy, since 27 percent of those alumni employed in education and functioning as teachers checked their field of specialization as education as well. Others who are teaching in educational institutions listed their fields as physics (16 percent), mathematics (11 percent), chemistry (7 percent), and electrical engineering (6 percent). All other fields, such as aeronautics, astronomy, biology, chemical engineering, and mechanical engineering were less than 5 percent.

Twenty-four percent hold the title of professor, 18 percent assistant professor, 15 percent associate professor, 8 percent scientist, and 5 percent instructor.

The median annual income for those in administration is $18,000. It is $11,000 for those in research and $10,500 for those in teaching.

The median annual income is $20,000 for chairmen. For professors it is $18,000, for associate pro-

fessors $13,000, for assistant professors $10,000, and for instructors $9,500.

Among those in education who list their primary function as research, 25 percent are in physics, 15 percent in chemistry, and 7 percent each are in biochemistry, electrical engineering, and mathematics. Six percent are in geology.

Government

About half (45 percent) of the 12 percent of Caltech alumni who are employed by government are in research. Another quarter are in administration, with 10 percent each in design and development, and 5 percent each in operations and consulting.

The fields of specialization within government employment that contain significant numbers are:

Field	*% of those in gov't employment*
Civil engineering	18
Electrical engineering	15
Physics	14
Aeronautics	8
Mechanical engineering	7
Geology	7
Meteorology	5
Chemistry	4
Mathematics	3

Somewhat over a third (36 percent) have the title of engineer or scientist, while 37 percent have a management title such as head, supervisor, director, manager, or chief.

Incomes do not have as wide a range as they do in education and industry—nor do they go as high.

Function	*Median annual earned income*
Administration	$15,000
Consulting	14,000
Research	13,500
Development	12,850
Design	12,000
Operations	11,500

Military

The six percent of alumni in the military are in development (24 percent), research (20 percent), administration (20 percent), design (14 percent), and operations (14 percent).

Almost half (42 percent) are in meteorology, 18 percent in electrical engineering, 13 percent in aeronautics, 10 percent in mechanical engineering, and 5 percent each in petroleum and civil engineering.

Those in development report the highest median annual incomes—which is contrary to the situation in industry, education, and the government.

Function	*Median annual earned income*
Development	$14,000
Design	12,750
Administration	12,500
Research	12,000
Operations	11,000

Leadership

Until fairly recently it was customary to think of scientists and engineers as working in relative isolation, and therefore needing no special managerial, administrative, or human relations skills. But complex research and development projects now involve large numbers of technically trained people, and managerial, supervisory, and leadership skills have great importance in determining job success. Our survey data indicate that this is particularly true for Caltech alumni.

Of the 4,269 working alumni, 881 have positions that indicate they possess outstanding management skills. These are the alumni who list their job titles as "owner," "partner," "president," "vice president," or "manager." They represent 20 percent of the total.

A second group of 415 have positions that would seem to require almost equal management abilities. They have such titles as "director," "chief," "superintendent," "chairman," "dean," or "head."

An additional 679 have job titles of "section head," "group supervisor," "group leader," "project supervisor," or "project leader." While working at a somewhat lower level of responsibility than the two preceding groups, alumni with these positions must certainly need managerial as well as technical skills.

These three groups, made up of the alumni with positions of top management responsibility, total 1,975. They represent 46 percent of all working alumni—which means that almost half of the alumni are now in positions that require skill in management, leadership, and human relations.

But even these figures do not provide the complete picture. Among those remaining there were 530 who reported that ten or more people were directly or indirectly responsible to them. Supervision of this number of subordinates certainly requires more than average leadership ability.

The same can probably be said for an additional 303 alumni who check administration as their job function. Administration almost always involves coordinating, or at least influencing, the efforts of others, often without recourse to any authority.

We have now included everyone we can identify directly as having important management positions or responsibility. They total 2,808 alumni and represent 66 percent of all those holding jobs. It is somewhat surprising to discover that two-thirds of our alumni, all highly trained in engineering, science, or mathematics, are actually devoting a large portion of their working hours to problems of human and organizational relationships.

Even among the 1,461 alumni remaining, many are in positions that require leadership and human relations skills. For example, there is a total of 276 "full," "associate," and "assistant" professors and instructors. There are 24 "advisors" and 22 "representatives." There are 169 who checked "other" rather than one of the titles provided – two-thirds of whom can be assumed to be in positions of management, since this was the proportion we found for the rest of the alumni. And there are also 187 "engineers" and 106 "scientists" who indicated they have between two and nine people responsible to them.

If we add these alumni to those whose occupations are more obviously managerial or administrative in nature, we have a grand total of 3,535.

This number represents 83 percent of all alumni. The pattern of modern research and development is becoming increasingly a matter of group activity dependent upon the collaborative efforts of many people. Caltech alumni are deeply involved in directing and coordinating these efforts.

Income

Alumni were asked to report their incomes from "occupation," "consulting," and "other" sources. Almost everyone supplied such data, permitting us to make several detailed comparisons:

Source of income	*Lower quarter*	*Median or midpoint*	*Upper quarter*	*Number reporting*
Occupation	$11,000	$13,500	$19,700	4,321
Consulting	1,200	2,600	6,000	542
Other	1,200	2,600	5,200	2,063
Total	11,700	16,000	23,300	4,454

At one extreme, 6 percent have total annual incomes under $5,000. They are mostly students. At the other extreme, 3 percent have total incomes over $50,000. (Ten report annual incomes over $100,000, three over $200,000.)

Only about 12 percent have income from consulting activities, and the highest proportion of these are among the PhD's in teaching positions.

It is interesting to make a direct comparison of the distribution of occupational incomes today, with those in the Caltech survey of 11 years ago. Inflation, the space age, and higher gross national product have combined to make some dramatic changes in these figures:

Income from occupation	*% in 1952*	*% in 1963*
Less than $1,000	4	1
$1,000-$5,000	14	6
$5,000-$7,000	28	2
$7,000-$9,000	25	5
$9,000-$19,000	26	59
$19,000 and over	3	27

Occupation

Earned income varies with field of specialization. The table below groups fields that have similar median incomes. The figures in the parentheses are the number of alumni checking that specialty as their main activity.

Median annual earned income	*Occupations in this income interval*
$10,000	Service occupations (12)
$11,000	Education (147), writing (11)
$12,000	Architecture (13), astronomy (30), biochemistry (50), biology (45), geology (175), mathematics & information processing (124), meteorology (36), military (133), sanitary engineering (17)
$13,000	Chemistry (208)
$14,000	Civil engineering (282), industrial design (14), physics (385)
$15,000	Chemical engineering (159), food (12), electrical engineering (698), economics (16), insurance (19), mechanical engineering (427), metallurgy (36), transportation (12)
$16,000	Merchandising, sales, advertising (44)
$17,000	Aeronautics (378), films (19), petroleum (91)
$18,000	Farming (10), medicine or dentistry (44)
$19,000	None
$20,000	Business and manufacture (445), finance (36), law (41)

The occupations in this list fall into three distinct groups on the basis of median incomes. In the first group ($10,000 to $13,000) are education, military, and science and mathematics. The second group has the engineering occupations, and the medians are $14,000 and $15,000. The third has business and the professions, with medians of $16,000 to $20,000.

Similar results appear when we compare earned incomes for alumni whose undergraduate major was in science ($13,000) with those who majored in engineering ($15,000). This differential, which is greatest in the decade immediately after the BS is earned, disappears in later years.

	Median annual earned income	
Years after BS	*Science majors*	*Engineering majors*
1 to 5	$ 4,300	$ 9,300
6 to 10	10,000	12,000
11 to 15	13,000	15,000
16 to 20	16,500	16,500
21 to 25	16,000	18,000
26 to 30	17,500	17,000
31 to 35	17,000	17,500
36 to 40	17,000	16,000
41 to 45	12,000	15,000
All ages combined	13,000	15,000

The median earned income of business and the professions ($20,000) is a high one. Only 23 percent of alumni have earnings equal to or greater than this. Another 23 percent earn less than $11,000 annually.

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Graduate Degrees

The median earned income for all alumni with the BS as the highest degree is $14,500. It is $13,000 for those with the MS, and $15,000 for those with the PhD.

The relatively low MS and PhD medians are due to the fact that many BS's are in industry, where the pay is high, while many MS's and PhD's are in education and government, where the pay is low.

Employed in	*% BS*	*% MS*	*% PhD*
Industry	70	60	40
Education	8	15	38
Government	9	11	12

	Median earned income		
Employed in	*BS*	*MS*	*PhD*
Industry	$15,000	$15,000	$18,000
Government	13,200	12,500	15,000
Education	8,000	10,000	12,000
Military	12,000	12,400	13,000
Other	8,400	9,000	16,900

The differential tends to remain the same for all years out of college.

Years after BS	*Median earned income*		
	BS	*MS*	*PhD*
1 to 5	$ 7,000	$ 8,900	$ 8,700
6 to 10	12,000	11,000	11,000
11 to 15	14,000	15,000	14,400
16 to 20	16,000	15,000	17,000
21 to 25	18,000	17,000	17,000
26 to 30	17,000	16,000	18,000
31 to 35	17,000	17,000	18,000
36 to 40	16,500	15,000	17,000
41 to 45	16,000	12,000	15,000

College

Study at Caltech pays off in dollars and cents for those earning advanced degrees.

Median annual earned income	*Degree combination*	*Median estim. undergrad GPA*
$13,500	BS CIT, MS other	2.8
$14,000	BS other, MS CIT	3.4
$14,500	BS CIT, MS CIT	3.0
$13,800	BS CIT, PhD other	3.0
$15,000	BS other, PhD CIT	3.6
$16,000	BS CIT, PhD CIT	3.2

The advanced degree holder earns least if he took his graduate work elsewhere, most if he did all of his work—both undergraduate and graduate—at Caltech. The pattern of median undergraduate GPA's for the different degree combinations suggests that those with BS's from other institutions are in the middle of the income ranges as a result of more stringent standards of admission to graduate study than is required of Caltech BS's.

It is usually taken for granted that students with high grades will be more successful than their classmates who get lower grades. Our data confirm this opinion, at least as far as earnings are concerned, although the difference is not great.

Grades	*Median total income*
As	$15,000
Bs	15,500
Cs	14,000

Our data also support the statement that outstanding achievement in extracurricular activities in college is predictive of later success. In fact, the income differential between *no* and *many* activities is the same as it is between A grades and C grades—$1,000.

Extracurricular activities	*Median total income*
None	$15,000
1 to 3 kinds	15,000
4 or more kinds	16,000

If high grades and participation in extracurricular activities are each accompanied by higher incomes, then the combination of both should increase the differences. This is true of Caltech alumni when we cross-compare the extremes:

	Median total income	
	Extracurricular activities	
Grades	*None*	*4 or more kinds*
A's	$15,000	$17,000
C's	13,000	13,200

The difference of $4,000 between the total income medians for C students with no extracurricular activities is four times the size of the difference for either grades or activities taken singly. We found similar differences in our 1952 survey, although at that time grades were not as influential as they are in this study.

Civic Activities

When we made a comparison of the total incomes of alumni who were very active in civic affairs with those who were inactive, we found very large differences. A further division into those with BS's in science and BS's in engineering revealed similar differences for both groups.

	Median total income	
Number of civic activities	*BS in Science*	*BS in Engineering*
None or 1	$ 9,000	$12,000
2 to 6	14,200	16,000
7 or more	17,000	19,000

These higher incomes should not be ascribed wholly to participation in civic affairs. An alumnus must be well established—and therefore often in a high income bracket—to have the time and opportunity to be active in civic affairs. There is undoubtedly a large proportion of young alumni in the low civic activities group. However, these figures, considered along with the higher earnings for alumni who were active in extracurricular activities, do

indicate that interest in community affairs has monetary as well as personal rewards.

Occupational Success

Earned income is an important indicator of occupational success, and by this standard Caltech alumni are certainly successful. But income is not an entirely satisfactory basis for judging the success of a group with members who often hold academic values higher than monetary rewards. In an attempt to overcome this difficulty, we asked alumni to report their fellowships, academic honors, publications, organizational offices, and directory listings.

A total of 350 have held important post-doctoral fellowships such as Fulbright, Guggenheim, NSF, and Sloan; 364 have received honorary degrees or other academic or professional honors; half (2,201) have published articles or papers, and 639 have each published ten or more; 561 have published a book or monograph, and 164 have published two or more; 649 are officers, directors, or trustees in a firm, institution, or organization that is not necessarily that of their occupation, while 247 hold two or more such offices; and 1,121 are listed in special directories such as *Who's Who* and *American Men of Science.*

These figures represent significant achievement for any alumni group.

There is some evidence that many of our alumni have a feeling of such accomplishment. In response to the question, "In your present job, do you consider yourself more, as, or less successful than the average?" over half (55 percent) thought they were "more successful." Only 4 percent thought they were "less successful."

We selected a group of alumni who had outstanding records in these activities for further study. They consisted of those who met any three of the following six requirements: 1) received a fellowship, 2) held an honor or award, 3) published two papers, 4) published a book, 5) was an officer or director in a firm or institution, and 6) was listed in a special directory.

There were 619 alumni, representing 14 percent of the total, who met this criterion. Forty percent were in industry, 40 percent in education, 13 percent in government, 2 percent in the military, and 5 percent in "other."

The kinds of accomplishment we used to select this group are more likely to be achieved by alumni with advanced degrees, particularly the doctorate. Sixteen percent of those who got a BS from another institution and a PhD from Caltech qualified for this achievement group. But 33 percent of those who received a BS from Caltech and a PhD from another institution, and 34 percent of those who received both their BS and PhD from Caltech are in this high achievement category. The relatively high proportion of PhD's with BS's from Caltech suggests either a highly selective undergraduate admissions program, or a very effective educational program.

Success, whether measured in terms of income or leadership positions, notable non-monetary achievement or self-evaluation, is implicit in the earning of a degree from Caltech. The relative extent of the success varies somewhat with the kind of degree, whether obtained entirely at Caltech or by some combination of Caltech and another institution, and the undergraduate major in which a degree was obtained. Yet, the over-all success of Caltech alumni when compared with other U.S. college alumni is undeniable.

This was also the conclusion arrived at from the 1952 alumni survey. At that time the median total income of Caltech alumni was $7,900—considerably higher than the $6,140 median income of all U.S. college graduates.

Dollar incomes have increased enormously in the United States in the 11 years between surveys. The U.S. Department of Commerce Current Population Report of September 29, 1964, gives the median U.S. family income in 1952 as $3,890, and in 1963 as $6,249—a 61 percent increase. The median family income for all white U.S. college graduates in 1963 was $9,900—again a 61 percent increase over $6,140 in 1952.

The median earnings of Caltech alumni, however, have increased 93 percent—from $7,000 in 1952 to $13,500 in 1963. And the median total income of Caltech graduates has increased 103 percent—from $7,900 to $16,000!

The median total income of Caltech alumni in 1963 was at the 88th percentile of the income for all U.S. college graduates. Current undergraduates and graduate students, dwell on this thought when you are dismayed, discouraged, and disenchanted with your labors. They *are* worth the time, effort, and money you are putting into them.

Fourth in a series of articles on the survey conducted last year by Dr. Weir, associate professor of psychology. In our next issue, Dr. Weir will discuss alumni opinions of life at Caltech and their suggestions for change or improvement.