

## CALTECH'S 1963 ALUMNI SURVEY

*Initial results of the 1963 survey show some striking changes since the last survey of Caltech alumni in 1952. The first in a series of articles.*

*by John R. Weir*

Caltech last studied its alumni by means of a questionnaire in 1952. In the 11 years that have elapsed since that survey was made, the total number of graduates has grown from approximately 6,000 to 9,000; the student body from about 1,000 to 1,300; the faculty from 343 to 515; Institute expenditures from \$5,200,000 annually to \$17,900,000; and Institute net assets from \$50,000,000 to \$124,000,000. These figures give some indication of the important changes that have taken place in the Institute since World War II.

As a consequence of these and other developments, our knowledge of Caltech alumni gained from the 1952 survey became obsolete. This led to the decision to conduct a new one. We expected the usual reaction to our lengthy lists of questions — and we got it. "Mail questionnaires are a pain in the neck!" was a fairly general comment by those completing their forms. Nevertheless, the information gained in the earlier survey was of such value to the Institute that it was decided to bring our information up to date even at the risk of imposing on the good nature of the alumni. We hope they will accept our thanks for the time and effort so many gave to help us learn more about our graduates. Perhaps this and the subsequent articles that will be published in *Engineering and Science* reporting the results of the survey will be of sufficient interest to repay them for their time and trouble.

In the 1952 survey, 67 percent of the 5,647 alumni for whom we had addresses returned completed questionnaires. Now, 11 years later, we have sent questionnaires to 8,051 alumni, and got a return of 61 percent. This lower response is somewhat puzzling in view of the fact that the 1952 questionnaire had to be returned with the alumnus's name attached to it (though it was later obliterated), while the 1963 form was completely anonymous.

In the latest survey we went to considerable labor and expense to maintain anonymity so the respondent would be encouraged to answer all questions fully. Each blank questionnaire was mailed with an Institute-addressed postcard containing the alumnus's name and address. Instructions were to mail this postcard separately, after the questionnaire had been completed and mailed. This card thus represented our only record of who had returned finished questionnaires and permitted us to send follow-up requests to those who had not responded. Since there was no identifying name on the questionnaire, the replies were as anonymous as possible on such a detailed questionnaire.

In the past we have often wished for more data on the relationships, if any, among grade-point average, extracurricular activities, and post-graduate achievement. We have attempted to gather these data in the present survey. Before the questionnaires were mailed out, the four-year grade-point

average from the Registrar's records, and extracurricular activities from Alumni Office records were coded and entered on the back cover of his questionnaire for each Caltech BS graduate. In addition, all alumni were asked to recall as accurately as they could their undergraduate grade-point averages. From these figures we hope to determine the relationship between college grades and adult achievement, honors, income, and occupation.

The data in each of the 4,884 returned questionnaires were classified into 200 items and key-punched into four IBM cards; coding and punching requiring 1,493 man-hours. After a few dozen hours of computer programming, the punched card data were transcribed onto magnetic tape and fed into the IBM 7094 computer in the new Booth Computing Center, which produced 168,480 tabulations on 378 feet of paper — all in 16 minutes and 47 seconds. This represents only the most simple tabulations; the more complex ones are yet to come.

## SURVEY RESULTS

### *Adequacy of the Sample*

The first question to be answered in any study of this kind is whether the sample from which the conclusions are drawn is reasonably representative of the total population to which the conclusions will be applied. There are two important ways in which our sample of respondents can be compared with the total graduate population. These comparisons are by age and by first degree.

#### AGE OF ALUMNI

	% Survey Sample	% All Graduates (estimated)
Under 30	20	20
30-39	29	28
40-49	29	26
50-59	16	18
60 and over	6	8

The sampling bias of age is a very small one. The sample is a bit short in the older age ranges, undoubtedly due to death and a waning association with the environment of early years, but here the percentages are relatively small and should not have important biasing effects on the survey tabulations.

#### FIRST DEGREE

	Number	% Survey Sample	Number	% All Graduates
BS	3257	71	5259	59
MS	938	20	2578	29
Eng.	68	1	242	3
PhD	347	8	858	10

Such differences as appear in this comparison can undoubtedly be attributed to the tendency for higher degree-holders to think of themselves as alumni of the colleges from which they got their bachelors' degrees. Consequently, they would not be interested in participating in this survey. This would seem especially true for holders of the master's degree, who usually spent one, or at the most two years at the Institute. Again, we probably have a large response from the BS degree-holders because they spent four years at Caltech and are still interested in it.

These two biases pose no problems for the purposes of this survey. Since we want to draw conclusions about Caltech alumni who are most representative of our graduates, it is to our advantage to have data from as many undergraduates as possible. It is also to our advantage to have a smaller percentage of the very large number of MS-only holders among the alumni, so that they will not distort the results.

These two comparisons indicate that the sampling bias is small, and in a direction that permits us to draw valid and useful conclusions about the California Institute from an analysis of our survey sample.

### *Early Background*

The new survey reveals some interesting and important trends in the size and location of the towns from which our alumni come. For example, in 1952, 39 percent of our graduates reported being raised in large cities; in 1963, this percentage has grown to 42. This is certainly not a large increase, and is probably a consequence of a general nationwide trend that has been going on for some time.

#### SIZE OF PLACE WHERE MOST OF PRECOLLEGE YEARS SPENT

	% in '63	% in '52
Farm	6	6
Small town	10	11
Small city	22	22
Medium city	20	22
Big city	15	14
Metropolis	27	25

Secondly, there is a shift in the part of the country in which our alumni grew up. In 1952, 56 percent reported they were raised in California; in 1963, this has dropped to 51 percent. At the same time, the proportion in '52 who said they were from the Midwest and the East totaled 20 percent, whereas in '63 this has grown to 26 percent.

GEOGRAPHIC REGION WHERE MOST  
OF PRECOLLEGE YEARS SPENT

	% in '63	% in '52
California	51	56
West	11	11
Midwest	16	14
South	7	9
East	10	6
Foreign	5	4

Finally, those who report graduating from high schools in southern California dropped from 53 percent in 1952 to 43 percent in 1963. At the same time, the total percent of those graduating from high schools in the rest of the West, the Midwest and the East went from 37 percent in the 1952 survey to 47 percent in the 1963 survey.

GEOGRAPHIC REGION OF HIGH SCHOOL

	% in '63	% in '52
Southern California	43	53
Rest of West	22	17
Midwest	14	12
South	6	6
East	11	8
Foreign	4	4

A similar trend can be observed in the recent figures for the high school origins of Caltech freshmen. In recent years about 40 percent of our freshmen came from California high schools, 15 percent came from the rest of the West, and 45 percent came from east of the Rockies and foreign countries. It also seems likely that the relatively recent increase in the number of graduate students at the Institute will reinforce this trend, inasmuch as they have gone to even more widely scattered high schools than have the undergraduates.

This shift of our student body and alumni from local or regional sources toward being more representative of the nation as a whole suggests that in a relatively short time Caltech will no longer be a predominantly "California" or "Western" institution.

*College Years*

The alumni are more highly educated than they were in 1952. The proportion with a BS as their highest degree has dropped from 45 to 36 percent, while those with MS as highest degree have risen from 32 to 34 percent, and those with doctorates and engineering degrees from 23 to 30 percent. In fact, alumni are now about evenly divided: 1/3 Bachelors, 1/3 Masters, and 1/3 Doctors.

HIGHEST DEGREE EARNED

	% in '63	% in '52
BS from Caltech	36	45
MS from Caltech	24	26
MS, non-Caltech	10	6
Doctorate or Professional, Caltech	20	17
Doctorate or Prof., non-Caltech	10	6

The increase in the frequency of higher degrees is also evident when we look at the decade in which the degrees were granted. As the table below indicates, there is a fairly even distribution of BS's for each decade since 1930. However, there is a definite increase in more recent years in the percent of Master's degrees earned, and a most pronounced change in the proportion of those earning the doctorate.

DECADES IN WHICH DEGREES WERE EARNED

	BS	MS	PhD
% 1910-1919	1		
% 1920-1929	9	2	2
% 1930-1939	20	14	13
% 1940-1949	32	30	16
% 1950-1959	30	37	46
% 1960-1962	8	16	23

*They Are Young*

The table above also affirms the relative youthfulness of our alumni. Almost all have received their degrees since 1930, while slightly more than half have received them since 1950. The greatest extreme is found in the column for the doctor's degree, where we see that over two-thirds of these degrees were earned after 1950. If the proportions for the 1960-1962 period hold through 1969, about half of all doctorates held by our alumni at that time will have been earned since 1960.

If we look at the age of our alumni rather than at the decade in which they received their degrees, we find further, but less dramatic, evidence of this youthfulness. The table below shows that half of our alumni are less than 40 years of age, and three-quarters are less than 50. At the same time, it is also evident that the alumni group is not as youthful as it was in the 1952 survey, when almost three-fourths were less than 40 years of age.

AGE OF ALUMNI

	% in '63	% in '52
Under 30	20	32
30 to 39 years	29	40
40 to 49 years	29	20
50 to 59 years	16	8 (50 and over)
60 and over	6	

These percentages are not as extreme as they

were 11 years ago, and another decade will see our alumni the same age as other typical alumni groups, yet our alumni will remain relatively young when compared with age distributions for college graduates in the general population. This fact should be kept in mind later on, when we analyze the post-graduate achievement of various degree-holders and attempt to evaluate their accomplishments.

### Undergraduate Major

#### MAJOR SUBJECT FOR BACHELOR'S DEGREE

	% in '63	% in '52
Aeronautics	2	
Astronomy & Astrophysics	*	1
Biology	2	2
Chemistry & Biochemistry	5	9
Chemical Eng. & Appl. Chem.	10	8
Civil Engineering	13	12
Electrical Engineering	23	20
Geology	3	5
Geophysics	1	
Mathematics	3	2
Mechanical Engineering	28	30
Physics & Applied Physics	10	11
Total in Engineering	63	62
Total in Science	34	38

\*Less than 1/2 of one percent

There are a few small differences in the percentages in various majors between the '63 and '52 surveys, i.e., a decrease in chemistry and chemical engineering and an increase in electrical engineering. These changes are both small, and are not matched by any changes in recent years in the actual number of degrees awarded in these majors by the Institute. Therefore it seems reasonable to ascribe the differences in this table to sampling errors.

However, since the 1952 survey there have been important revisions of undergraduate curricula and course requirements in almost all divisions of the Institute. Subject matter formerly taught in graduate courses now appears at the undergraduate level; concepts from sophomore and junior courses now frequently are part of freshman courses. In addition, there has been a noticeable increase in the number of undergraduates selecting mathematics or science as their major and a decrease in the number selecting engineering. These changes are too recent to affect the results of this survey, but some idea of the probable future effect may be gained from the fact that while the survey indicates roughly two-thirds engineering and one-third science majors, the percentage of engineers within graduating senior classes in the last ten years has declined from 50 to 30 percent, and may go even lower.

### Graduate Majors

#### MAJOR SUBJECT FOR HIGHEST ADVANCED DEGREE

	% in '63	% in '52
Aeronautics	10	18
Astronomy & Astrophysics	1	*
Biology	1	2
Chemistry & Biochemistry	11	10
Chemical Eng. & Appl. Chem.	5	5
Civil Engineering	6	7
Electrical Engineering	17	14
Geology	5	6
Geophysics	1	1
Mathematics	3	2
Mechanical Engineering	12	10
Physics & Applied Physics	14	12
Business Administration	3	2
Law	1	2
Medicine	1	1
Meteorology	3	5
Other	6	3
Total in Engineering	45	49
Total in Science	41	35
Total in Other	14	16

\*Less than 1/2 of one percent

Among the graduate majors there is only one change from 1952 to 1963 that may not be due to sampling error. It is the drop in the percentage of alumni who hold degrees in aeronautics — from 18 to 10 percent. During World War II Caltech had a Navy V-12 training program that produced a great many graduates in aeronautics. Since 1947, when this program was discontinued, the production of aeronautics graduates has returned to prewar levels. Consequently, the total of aeronautics majors has not increased in volume to the same extent as other majors. Furthermore, at the time of the 1952 survey a large proportion of all aeronautics majors were V-12 graduates who, after the 11 years between surveys, probably no longer feel close to the Institute or sufficiently interested to participate in the survey.

The proportions of engineers and scientists among graduate degree-holders are more nearly equal than they are among undergraduates. The increase in the proportion of scientists and the decrease in the proportion of engineers is partially accounted for by the changes in the aeronautics major. It may also be due in part to a recent trend at the Institute toward the granting of more degrees in science and fewer in engineering. This change is paralleled at the undergraduate level. If the trend continues it may ultimately result in Caltech becoming an institute of pure and applied science, with a small proportion of majors in engineering pursuing a course of study quite similar to that of the science majors. The recent change in the name

of the Engineering Division to Division of Engineering and Applied Science may be a portent of things to come.

### Religious Affiliation

We found in the 1952 survey that our alumni were predominantly Protestant in their religious affiliation — much more so than U.S. college graduates in general. While this is still the case, there have been some small but interesting changes.

RELIGIOUS AFFILIATION

	% in '63	% in '52
Protestant	77	84
Catholic	8	7
Jewish	8	5
Other	7	4

The decrease in the percentage of Protestants and the increase in Catholics and Jews was evident in the 1952 survey when alumni under 30 were compared with those over 50. The percentages for the younger group were very similar to the '63 figures, which suggest a broadening base of religious affiliation among our alumni.

The foregoing figures on religious affiliation are derived from answers to the question: "Were you brought up as a . . . Protestant? . . . Catholic? . . . Jew? . . . Other?" They do not reveal the amount of active participation in religious affairs. When asked how frequently they go to church, a more definite attitude emerged. In 1952, 29 percent were active churchgoers. In 1963, this number had grown to 36 percent. At the same time, 50 percent of the '52 sample attended church rarely or not at all, while only 46 percent of the 1963 sample report nonattendance.

FREQUENCY OF CHURCH ATTENDANCE

	% in '63	% in '52
Now go to church every week	19	13
... pretty regularly	17	16
... a few times a year	18	21
... rarely	20	26
... not at all	26	24

While there is a slight increase in church attendance in the 1963 sample, Caltech alumni could hardly be called a churchgoing group, since almost half of them go rarely or not at all.

### Parents' Education

Less than ten percent of all Americans who are old enough to have a college degree actually do

have one. And so, on the average, one might expect this proportion to be true for the parents of college graduates. However, it is known that college graduates tend to encourage their offspring to attend college. Consequently, the percentage of parents of college graduates who also attended college is considerably more than ten percent.

Among Caltech alumni, almost half of the fathers and more than one-third of the mothers attended college. Over 50 percent of our alumni report that one or more parents attended college.

ALUMNI WHOSE PARENTS ATTENDED COLLEGE

	% in '63	% in '52
Father attended college	45	43
Mother attended college	36	33

These percentages are higher than the national average, and indicate that Caltech alumni come from highly educated families. However, some other colleges have student bodies with a higher proportion of parents who attended college. For example, a recent cooperative study compared the parents' education of Caltech students with those of science majors in an Ivy League college. The percentage of fathers with only a high school education was 37 for Caltech, and 27 for the Ivy League college. Twenty-five percent of the Caltech fathers had attended graduate school, while 50 percent of the Ivy League college fathers had done so.

About the same proportions held for the mothers' education. Forty-five percent of the mothers of Caltech students had a high-school-or-less education, versus 29 percent for the Ivy League mothers. And, at the other extreme, only 8 percent of Caltech mothers attended graduate school while 17 percent of the Ivy League mothers had done so.

These differences in family educational background are probably due to several causes. Perhaps different social class position, a longer tradition of college attendance, and more entrenched intellectual values are more characteristic of an Ivy League student body than of Caltech's. But future articles on our survey results will show clearly that Caltech alumni are hard to beat when it comes to academic honors and other notable achievements in later years.

*This is the first in a series of articles to appear in ENGINEERING AND SCIENCE reporting the results of the survey of Caltech alumni made last year. The next issue will take a look at some of the political and cultural interests of our graduates.*