

## OUR BEST FRESHMEN ARE GETTING BETTER

by L. A. DuBridge

There are three questions any college asks about a prospective freshman:

1. How bright is he?
2. How well prepared is he?
3. What kind of person is he?

The first two questions are easier to answer than the third. But if we have plenty of bright and well-prepared candidates to select from, then we can select the ones that appear to be honest, earnest, hard-working, imaginative, ambitious, and reasonably easy to get along with.

How do we know how bright a high school senior is? We can ask his parents of course, but we haven't found that very helpful. We can ask his teachers—and that turns out better. Indeed, if you can talk to the teacher face to face, instead of just asking for a letter of recommendation, you can often learn a lot about a student—even how good a guy he is. (Even here, however, one must be careful. You would be surprised how many students we have admitted at Caltech who were described by their teachers as budding young Einsteins—who flunked out in their first year.) Then we can look at a student's grades. That helps too—but, as everyone knows, "A" grades don't always mean the same thing at different schools.

And, finally, we can look at the results of certain tests.

And here I must digress for a moment to talk about testing. A report on testing was issued last February by a committee representing several large associations of school administrators. This report very properly brought out certain misuses and abuses of large-scale national, state, and local testing enterprises. It noted that no test is perfect, that tests can never tell the whole story about a student's qualifications or abilities, and that blind reliance on numbers and statistics can be misleading—and even tragic to individual students. Also, testing requires a certain amount of time.

These things are well known. But to go a step further, as the report did, and cast aspersions on all testing procedures—including the valuable College

Entrance Examination Board tests—is to throw a frightfully damaging blow at the cause of good education. For the College Board tests have, on the whole, been an extraordinarily useful and reliable instrument for selecting from high schools all over the country those students particularly able and particularly well prepared to undertake a rigorous college or university program. No major college or university seeking exceptionally talented students could possibly do its job so effectively without such nationally administered tests. And, if there are incidental problems and abuses, these shrink to insignificance alongside their great values and proven worth.

So we use College Board tests to help us find the best students in the country to admit to Caltech. And so do other leading institutions I have looked at. On the basis of these test scores, it is concluded that the freshmen these institutions have been admitting have greatly improved in quality in the past five to ten years—and their performance in college has improved in direct proportion.

Let me cite a few Caltech figures to illustrate:

In 1951 our freshman class turned in scores on the verbal aptitude test (which measures ability to use and understand the English language) which ranked the average freshman at the 75th percentile of all those taking the tests in the country.

In 1961, in these same tests, our average freshman was at the 97th percentile. That is, half of our freshmen were above 97 percent of all college applicants, and half below.

In the mathematical aptitude test our average freshman in 1951 was at the 89th percentile; in 1961, at the 99th. In the physics achievement test the average rose from the 82nd to the 97th percentile. In the advanced mathematics achievement test, it went from the 68th to the 96th. And in English (even though we are a school of science and engineering) our average freshman was at the 68th percentile in 1951; at the 89th in 1961.

There is no way on earth we could have found a group of students in the top 1 or 2 or 3 or 4 percent of the entire country if we had not had something

like the College Board tests to go on. The experience at Harvard, Yale, Princeton, MIT, and Stanford is similar — a rise of from 10 to as much as 40 points on the percentile scale for the average freshman in the past ten years. Princeton reports that their entire list of applicants last year was above the level of those actually *admitted* ten years ago.

The old-style admissions procedure for some old-line universities was to depend on graduates of a few fine old-line private schools — ignoring a host of graduates of public schools — because there was no adequate yardstick for comparison. Today the typical university draws students from high schools of all types all over the country. Our 182 freshmen last year came from 173 high schools, only 25 of which were private schools. And nearly half of our freshmen came from schools east of the Mississippi River. MIT reports that its 900 freshmen came from 615 high schools — 87 percent of them public schools. And 87 percent of their students came from outside of New England. And so it goes. Never could we have spotted these bright students from all over the nation if we did not have some nationally administered testing procedure.

### *College performance*

And have these students performed in college in a way to bear out their high test scores? They have indeed. We find very close correlation between college performance and entrance test scores. And, as the freshmen have improved, we have had to advance the quality and content of our college courses in order to keep up with them. Most of our freshmen of ten years ago would have flunked dismally in competition with our freshmen of today — except, of course, if the freshman of ten years ago could have gone to the high school of today, he would have done better also.

Thus, on the basis of both test scores and college performance, we can say that the freshmen at these institutions are on the average brighter than they were ten years ago. That, of course, is because we can be more selective than we used to be.

But there is an even more important matter — namely, the quality of preparation which these students have received in high school has been rapidly improving too.

The CEEB advanced mathematics achievement test was so adjusted 15 years ago that a “perfect” score was 800 — and was attained by very, very few high school seniors. Today thousands of them hit the ceiling at 800. Half of all our freshmen got scores above 762 — which is so close to 800 that it is not worth arguing about. The MIT freshmen were right up there too.

But that is only the beginning. The old advanced mathematics tests covered only algebra, trigonometry, and geometry. Today thousands of high school seniors are taking courses in calculus. And so a whole new

test series had to be devised to cover that subject.

This is one part of another contribution of CEEB. Ten years ago a group of universities set up a special commission to study high school mathematics teaching and concluded that many students could profit greatly by taking so-called advanced placement courses, so they would be further ahead when they reached college. High school and college teachers cooperated in preparing such courses, and special tests were constructed by the CEEB so that colleges could give advanced credit to those who passed successfully.

### *Advanced placement*

Last year 9 percent of the MIT freshmen entered with advanced credit for the first semester of their calculus course, and 11 percent more got credit for the whole year, and several for a full two years — as a result of advanced placement courses in calculus which they took in high school. Twenty percent of the Caltech freshmen were able to skip the first half of our calculus course — and that is a far more advanced course than it was six years ago.

The advanced placement program spread to other subjects, physics and chemistry particularly, and advanced English and history are now being developed.

Ten years ago only a few high schools offered such courses. But in 1961 some 13,000 students from 1200 high schools took advanced placement tests. Many more schools are preparing to enter the program. Still more have substantially improved their regular courses.

The colleges have, of course, responded to these better freshmen. A few years ago we completely revamped our freshman chemistry course at Caltech because most of our students had covered that material in high school, some in advanced placement courses but mostly in regular high school courses. We put most of the old sophomore course and some junior work into the freshman year. And the present freshmen are eating it up.

Our physics course is just now being thoroughly reorganized. We begin the course now with the introduction of basic principles and concepts of modern physics: atomic theory, conservation of energy, relativity, and quantum theory. We no longer need to review the stuff about pulleys and levers and inclined planes.

This is possible because of the improved physics courses in high school, and the improved mathematics courses. As I have said, 20 percent of our freshmen have had high school calculus. The rest are so well prepared in geometry and trigonometry that we no longer spend weeks reviewing those subjects, but plunge into calculus the first week of the freshman year. So the physics teachers can start using calculus immediately, greatly improving the approach to basic physical ideas.

And what about English? We hear that “Johnny

can't read"—and that engineers never could read. Well, ours can!

We used to give remedial reading instruction for the 20 percent of our freshmen who needed it. There are almost no takers today. We abolished our old freshman English course a few years ago because all of our freshmen proved they could qualify at once for the advanced course in literature—one that used to be reserved for juniors. We always had a few students good enough to qualify for that course on entrance; but in the past five years the percentage admitted grew from 10 percent to 100 percent. And to see and hear those freshmen reading, discussing, and writing about the basic ideas to be found in the best English literature is an astonishing experience indeed. One of our professors gives a course in Shakespeare for those who have completed the present freshman course. These science and engineering students do as well in that course as his *senior* English majors used to do a few years ago in a famous liberal arts college where he then taught.

Our history faculty has abandoned the old introductory college history texts and in the sophomore year now gives a solid introduction to the history of ideas as revealed in the best scholarly books on the subject.

This story is repeated in greater or lesser degree at Harvard, MIT, Princeton, and Stanford. And more casual inquiries at other colleges with high entrance standards tell the same story.

### *Advanced students*

At Harvard last fall 540 of their 1200 freshmen passed 1396 advanced placement tests—nearly three each. One hundred thirty-four of these freshmen did so well in enough subjects that they were offered full sophomore standing. As a matter of fact, Harvard now admits freshmen to advanced courses *without* tests, but solely on examination of the record. They have, I am told, a new type of advanced student called TYWI: "Talk your way in."

Harvard, like Caltech, has also dropped its former remedial courses in mathematics and English. They are no longer needed. At Princeton the situation is similar. A *majority* of their freshmen this year entered one or more courses in advance of the normal freshman level. The same is true at Yale, which also reports great improvement in the foreign language preparation of its freshmen.

At MIT last fall 224 of the 900 freshmen received college credit in 504 semester courses—mostly in calculus, in physics, in humanities, and in foreign languages. Furthermore, many freshman courses have been advanced in level and the old remedial courses designed to make up for high school deficiencies are no longer needed.

I think you can see why I say our best freshmen are getting better—getting better *fast*.

Thousands of our best high schools are now actively and effectively seeking out their gifted students, counseling them more adequately about preparing for college, and providing challenging solid courses for them, which makes them far more mature college freshmen than were their counterparts a dozen years ago.

I have been talking about the best high schools and their best students. There are thousands of schools which lag far behind. There are many thousands of talented boys and girls who have no chance to prepare themselves for first-class colleges. Our educational system still has far to go. But those who say it is not even on the way are ignoring the story I have been telling you.

Colleges face another problem: The high schools that do not give advanced courses, or even very good courses, may still have some very bright students. Colleges hate to turn these students down. Yet they face a serious problem in offering them special "catch-up" work, or letting them face a serious preparation gap compared to their more fortunate colleagues. One college officer reports that many bright freshmen (just because they were bright) were allowed to take a lighter load of work in their high school senior year—substituting credits for participating in the band, the student council, or the year book for solid college preparatory subjects. "This," he says, "constitutes cruel mistreatment of a bright boy who will face five substantial courses when he enters college."

Some college officers inform me they fear that the advanced program might be carried too far. The prestige value of advanced courses may cause schools to outrun their teaching competence, or force impossible tasks on unqualified students. Then, too, some fear that young students, quite able to grasp mathematics, science, and foreign languages, may be unable to cope with advanced work in literature, history, or philosophy which requires greater maturity of mind. The result of this might be the emergence of intellectual snobbishness and cynicism.

### *Encouraging talented students*

In spite of these fears—and of other fears which have not yet materialized—the conclusion is that an important but little noticed ground swell is under way in hundreds of high schools throughout the country. These schools are trying to find their most talented students; they encourage them and offer them opportunities for better college preparation. The colleges (at least some of them) see these students coming in rapidly increasing numbers; they have welcomed them into advanced college courses, and are rapidly altering their curricular programs to meet this new situation. Clearly we have neglected our talented high school students too long. But clearly, too, we are finding a way out of this intolerable situation.