

PROJECTED OUTPUT of PHYSICISTS

Data from an article on "Education and Employment on Physicists" (Physics Today, Jan. 1960) serve as a basis for a forward look at physics majors' enrollments. Dr. Barton is associate director of the American Institute of Physics.

By Henry A. Barton

THERE is now available a "Projection of Earned Degrees to 1969-70" issued in September 1959 by the Office of Education of the US Department of Health, Education and Welfare. The document also lists the number of degrees actually awarded in the period 1947-48 to 1957-58. Also available from the same office is a compilation of degrees awarded in physics in the period 1947-48 to 1957-58 inclusive. The Office has not attempted, for publication at least, to project the number of future physics degrees. The present paper makes such an attempt. It is limited to a projection of degrees at the baccalaureate level, which is uncertain enough. To go on to advanced degrees involves projections of projections which are quite obviously unreliable.

The cited Office of Education "Projection" is based, in the nearer future years, on enrollments already in institutions, and thereafter on the known population of appropriate age groups. The ratios employed in the various steps are projected by continuation of the time trends of the ratios. Hence expected changes in the fraction of the age groups which complete college courses are apparently taken into account.

Table I presents the recorded data for the period of 1947-48 to 1957-58 giving the number of *all* bachelor's degrees awarded, the number awarded in physics, and

the percentage which the latter constitutes of the former. One may deal with the trend of these percentages in an attempt to project the future output of physics majors. Fig. 1 shows them graphically. Incidentally, a projection of independent data obtained from the annual enrollment surveys of the American Institute of Physics, even after reduction to correspond with Office of Education figures, suggests that points for 1958-59, 1959-60, and probably 1960-61 will lie above line *A* in the figure which was drawn to indicate the almost linear upward trend from 1954-55 to 1957-58.

Clearly, it is not possible on the basis of these data to project with confidence the percentage of baccalaureate degrees which will be awarded in physics in the next few years. The curve could go on up like line *A* or, as currently, even faster. On the other hand, it cannot continue to rise indefinitely and, after going through a maximum, may decline again.

One is forced back on his own appraisal of the national climate for the encouragement of physics study relative to the totality of other fields. Defense economy waves, injustices based on "security" considerations, and other possibilities may be cited as potential "negative" factors. Then too there are some persons influential in forming student attitudes who unfortunately depict science as antagonistic to the humanities and not essential as a part of the general culture!

On the other hand, there are many signs of an improved public understanding of the work of physicists and of growing prestige for their profession. Other "positive" factors are the expansion of nuclear, solid-state, "space", and certain other fields of physics research; the increasing percentage of employment of physicists in industry; the current shortages of physicists in essentially all fields of employment; the increasingly technological character of civilization; the competition with communist countries, etc. Drastic changes in the general economy might have either a positive or negative effect on the demand for and supply of physicists. Fig. 1 may be helpful in translating one's resultant impression into figures.

Table II gives, for example, a projection in which

TABLE I. Annual Output of Physics Major Bachelors Compared With Bachelors in All Fields
(Based on Office of Education Data)

<i>Academic Year</i>	<i>Degrees in All Fields</i>	<i>Physics Degrees</i>	<i>Percentage</i>
1947-48	272 311	2126	0.78
1948-49	366 698	2828	0.77
1949-50	433 734	3414	0.79
1950-51	384 352	2788	0.73
1951-52	331 924	2247	0.68
1952-53	304 857	2005	0.66
1953-54	292 880	1952	0.67
1954-55	287 401	1996	0.69
1955-56	311 298	2335	0.75
1956-57	340 347	2745	0.81
1957-58	365 748	3186	0.87

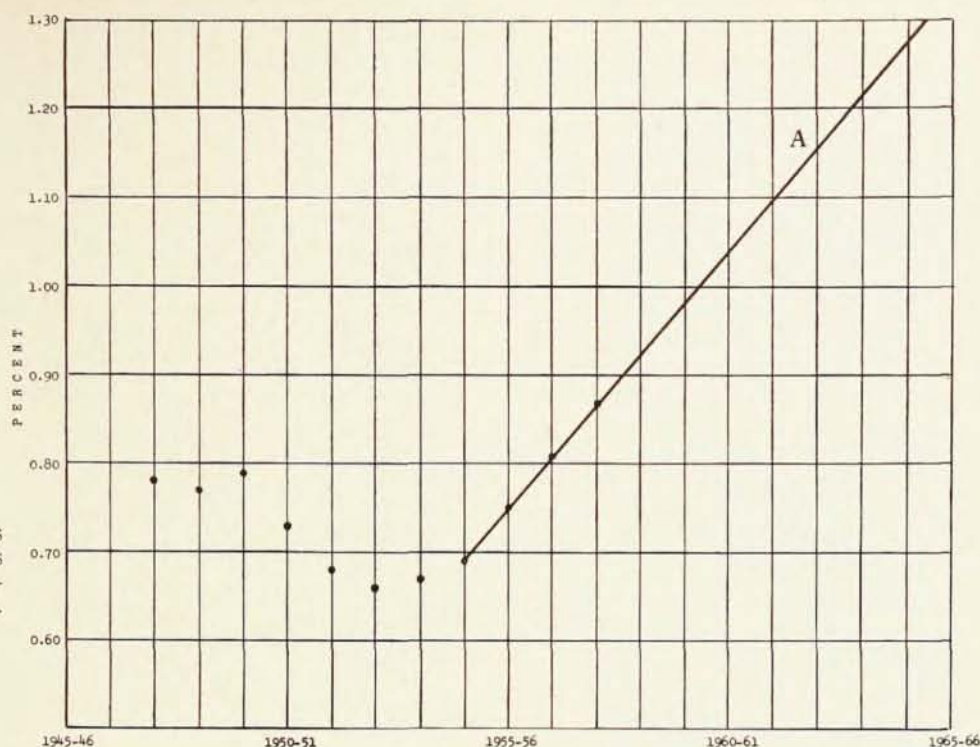


Fig. 1. Bachelor's degrees awarded to physics majors expressed as percentage of degrees awarded in all fields.

the percentages of the quite arbitrary Curve A are applied to the Office of Education data for all fields in order to estimate the baccalaureate output of physics majors. On this assumption somewhat more than 11 000 physics major baccalaureates will be awarded annually by the end of the new decade. If it be more pessimistically assumed that the percentage in 1969-70 is again (after being higher) back to 0.87 as in 1957-58, the output will be 6300. This is just saying that the increase will only be proportional to the over-all college output. In view of the large spread between the estimates of 6300 and 11 300 or higher for 1969-70, perhaps all one can say is that the figures then will be at least two or three times what they are now. This seems

conservative, but of course it does depend on whether the projected total college output is realized.

For consistency this study has been based entirely on Office of Education figures which are compiled from reports obtained from college and university registrars. The AIP conducts an annual survey of enrollments and degree awards, obtaining its data from the heads of physics departments. The AIP figures for physics-major bachelors run roughly 10% higher than those of the Office of Education.

It is possible to use projected degree figures to estimate corresponding physics-major enrollments. The number of fourth-year students runs about 8% higher than the number of degrees awarded the same academic year. The number of third-year students runs about 25% higher than the number who will obtain degrees a year later. For example, if one accepts the projection of Table II, the enrollments in 1968-69 are projected to be 14 100 in the third year and 11 600 in the fourth year. If the AIP figures are to be accepted rather than those of the Office of Education, 10% must then be added, making the figures 15 500 and 12 800 physics majors enrolled in the third and fourth years. If trends now appearing are maintained, the numbers may be even higher.

It is sobering to contemplate such figures in the light of the already serious teacher shortage in many colleges. Unless means are very promptly found to counter this difficulty, the bachelors of ten years from now seem destined to face their careers or their graduate study with poorer preparation than those now in college. If, on the other hand, the teaching were so inadequate as to give physics a bad college reputation, the projected enrollments might not materialize!

TABLE II. Projected Annual Output of Physics Major Bachelors

(Based on Curve A of Figure I)

Year	O. of Ed. Projections of Total No. of Degrees	Percentage Read from Curve A	Projected Physics Major Bachelors
1958-59	390 000	0.93	3 630
1959-60	405 000	0.99	4 010
1960-61	406 000	1.05	4 260
1961-62	430 000	1.10	4 730
1962-63	465 000	1.16	5 400
1963-64	513 000	1.22	6 260
1964-65	534 000	1.28	6 830
1965-66	536 000	1.33	7 130
1966-67	561 000	1.39	7 800
1967-68	657 000	1.45	9 520
1968-69	711 000	1.51	10 730
1969-70	718 000	1.57	11 300