once prominent, has been sadly neglected in recent years by astronomers in this country. The need for research in instrumentation in this branch of astronomy is as great as in any other. It should have been included with radio astronomy and astrophysics in the statement of requirements prepared by the National Academy.

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Exams: The College Boards in Chemistry

In his letter (25 Sept., p. 1385) discussing the relation of the College Entrance Examination Board to various curriculum studies, Frank Fornoff says, "In chemistry and biology, studies made to date have not demonstrated the necessity for special tests for the new curricula." This statement may leave the reader with the false impression that CEEB *in its present state* adequately measures performance of students who have taken the new courses.

In a study made by Educational Testing Service of the 1962–63 administration of the CEEB exam, it was found that students in the two new chemistry curricula (CBA and CHEM Study) had an average handicap of 32.7 and 40.7 points, respectively. This is not surprising when one compares the content and emphasis of each of these new courses with those of the CEEB exam. We understand that the content of the exam is evolving, but that there is a 3- to 5-year lag between the writing of questions and their appearance on the final form of the exam.

It seems doubtful that a conclusive answer will ever be found to the question of whether or not any single examination can adequately measure students' performance in a variety of kinds of high school chemistry courses. Perhaps a more useful question is whether or not such an exam can accomplish its purpose of predicting success in college courses. Diversity in freshman college courses makes this question hard to answer quantitatively. Data are being gathered in freshman courses in a dozen colleges and universities this year in order to compare the performances of students who took CHEM Study courses with those of students who had other kinds of chemistry courses in secondary school. There is already strong evidence that CHEM Study students fare better in their freshman courses at Berkeley than their conventionally trained peers. If this proves to be generally true despite lower scores on the CEEB exam, then the validity of that exam must be questioned. Results of the survey will be available in about a year.

No matter how these questions are eventually answered, the present widespread use of an exam which handicaps CHEM Study and CBA students is presumably having two deleterious effects. One is to deter some school systems and teachers from either adopting the new approaches or giving emphasis in their own courses to up-to-date treatment of principles not covered on the examination. The second is that some students who take the exams and are handicapped on it may indeed be put at a disadvantage in a competitive scramble to get into certain colleges. Both ETS and CHEM Study have taken measures to try to prevent these things from happening, but there is no way of knowing how effective the measures have been. The unhappy fact remains that, stated intentions of the CEEB notwithstanding, the exam is accepted by many as an absolute standard and, so accepted, tends to inhibit needed change in high school course content and to penalize well-prepared students unfairly.

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Who Proved Galileo Right?

In his letter concerning Galileo and the Church (20 Nov., p. 998), Michael Holt remarks that "the world had to wait two centuries" (after Galileo's trial) for the discovery of stellar parallax, which by strong implication is represented as the first satisfactory observational proof of the orbital motion of the earth. The world had, in fact, to wait only about one century for an observational development which no scientist then or now long hesitated to accept as a demonstration of the earth's orbital motion fully as satisfactory as the detection of stellar parallaxes: the (admittedly unexpected) discovery of stellar aberration by Bradley in 1727, more than a hundred years before Bessel published his first reliable parallax.

The point just made is not altogether trivial in the midst of discussions about authoritarianism, in view of the tardiness of the *Index* (1835?) in reconciling itself fully to the Copernican system. Perhaps more interesting, however, is the variation in opinion on the character of "proof," as evidenced by Holt's desire, on the one hand, for the observational detection of stellar parallax (how embarrassing had the distances of the stars been still greater than they are!) and Father Marasigan's willingness, on the other hand (in his letter in the same issue), to accept as proof the analysis of "the observational data of Brahe and Kepler . . . in the light of Newton's law of gravitation," for which the world had only to wait about half a century after the trial. I strongly doubt that Holt or anyone else thinks that modern attitudes concerning the nature of scientific proof were of any great importance at that trial, but I agree that the Church fathers must not bear the entire blame.

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I was surprised to see a letter (20 Nov. 1964, p. 997) citing as an authority the antiquated and highly slanted White, *A History of the Warfare of Science with Theology in Christendom* (published 1895). It is unfortunate that the author of the letter, R. F. McGregor, has not consulted such sources as de Santillana, *The Crime of Galileo* (Chicago, 1955); Drake, *Discoveries and Opinions of Galileo* (Doubleday Anchor, 1957); and Koestler, *The Sleepwalkers* (Macmillan, 1959). Although one may doubt some of their interpretations, their documentation is much more comprehensive than that in the older works.

It is probably too strong to say that Cardinal Bellarmine was a friend of Galileo (see Drake, pp. 74f). But he acted as a friend to science in trying to dissuade Galileo from pushing the Copernican hypothesis onto Paul V (*ibid.*, p. 170; Koestler, pp. 447–449, 453). In this he was joined by other cardinals, Barberini, del Monte, and Galileo's close friend, Dini (Koestler, pp. 445, 446, 454). White's statement is directly contradicted by Bellarmine's certificate to Galileo (*ibid.*, pp. 463, 484; de Santillana, p. 132).