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).

Galileo was acclaimed by Maffeo Barberini, who wrote a poem in his praise (quoted by de Santillana, p. 156), who gave him friendly audience after becoming Pope Urban VIII (*ibid.*, pp. 162–166; Koestler, pp. 472f, 480), and who loaded him with honors (de Santillana, p. 171; Koestler, p. 472), but who later turned against him (de Santillana, pp. 191f, 217f, 222, 283; Koestler, pp. 482f, 495).

As for the condemnation of works referring to the movement of the earth, this was flouted by the Jesuits in China (Koestler, p. 495).

Finally, McGregor's slur on Gibson's questions is unwarranted. In the light of the vaunted claims of science to objectivity, honesty, experimental method, and so on, a *single* example of authoritarianism, "pull", acquiescence, or any other of the evils mentioned by Gibson (*Science*, 18 Sept. 1964, p. 1276) is too many. Perhaps a reading or rereading of Barber's "Resistance by scientists to scientific discovery" [*ibid.* **134**, 596 (1961)] would be beneficial.

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The Waldemar Experience

The Waldemar Medical Research Foundation has been under attack of a more serious nature than might at first appear from the information given in *Science* (News and Comment, 2 Oct., p. 39). The scientific staff of Waldemar asks that our present plight be widely publicized so that scientists may be forewarned and therefore forearmed against similar attacks upon other scientific groups in future. The attack on our laboratory by a local newspaper can only be characterized as an anti-intellectual attack on the freedom of scientific inquiry and on academic freedom. The charges against Waldemar are baseless and were fabricated by the newspaper, under lurid headlines, through implication and innuendo. Were ours a unique situation, this warning to the scientific community would perhaps be unnecessary. But other such attacks have occurred. Queens College, a division of the City University of New York, has been the butt of continued harassments by newspapers on the false grounds of religious discrimination. Several years back, Miami Cancer Institute was similarly beset by newspapers.

The scientific community should have channels for aiding beleagured institutions such as ours with statements of support. Should not *Science* provide these? *Science* is the only organ that has brought our plight to the attention of the community of scholars, and the article by Elinor Langer presented our situation concisely and quite clearly. But its effect is diluted by a nonpartisan tone. Abraham Lincoln told a story about a wife who was nonpartisan even when her husband was attacked by a bear. "Go it, husband! Go it, b'ar!" she exhorted.

Langer wrote, "The Waldemar story . . . underscores the vulnerability of private research laboratories that lack affiliation with a large university or other institution." The strengths of small institutions are no more or less than those of larger ones, and affiliation with a larger institution might not have prevented such an attack. Moreover, scientists have long urged the importance of small institutions in scientific research. We at Waldemar have found that a small band of scientists can build a research center that offers unique advantages both in freedom of work and in support of each other's research efforts, and in addition a large measure of responsibility in a cooperative effort rooted in informed community support. Langer says, "There is no doubt that Waldemar's experiment in establishing close ties with the local community has failed." This is not so. On the contrary, the responsible elements of the community favor Waldemar's activities and recognize their value. The experiment is still in progress. A little assistance may yet make it a success.

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Academic Organization of Science

Booker's interesting suggestions on academic organization in physical science (2 Oct., p. 35) can well be extended even further in two respects. First, the arguments presented for the unification of the "theoretical, experimental, observational, and applied" are generally applicable not only in physical science as he defines the term, but also in biology, chemistry, mathematics, and even in a number of the areas typically classified as the humanities and the social sciences. Second, there is need to recognize within this unification a fundamental and necessary difference between the viewpoints of the "pure scientist" and the engineer; this has to do with the role of economics in the exercise of their responsibilities.

Several of the points mentioned by Booker were already in the academic plan of the new California State College at Palos Verdes, now preparing for opening with undergraduate programs in September of 1965 and for adding graduate work later. The entire curriculum is within a framework of the liberal arts and sciences and is being organized into three schools—natural sciences and mathematics, humanities and fine arts, and social and behavioral sciences. Specialized programs in the applied arts and sciences will be developed within this framework. A new type of basic studies program and a unique combination of both departmental and interdepartmental majors for baccalaureate students will provide further means for achieving both depth and breadth, and for properly relating the applied to the theoretical.

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Tempora Mutantur

In my early days, authors were financially compensated for contributions to some scientific periodicals in Germany. Dael Wolfle (editorial, 13 Nov., p. 869) reports that nowadays journals are following the leadership of the American Institute of Physics in levying page charges against the authors' institutions.

At present, each newborn child is an additional tax deduction. But overpopulation may soon make it mandatory to levy a tax for each offspring, as suggested by Joshua Lederberg and F. H. C. Crick (see Crick's *Man and His Future*, Little, Brown, Boston, 1963, p. 275).

Are we ready? Lothar's *tempora mutantur* is amply proven, but what about his *nos et mutamur in illis*?

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