they'd like to take physics and chemistry, rather than the easier zoology-botany or astronomy-geology sequences they chose to fulfill distribution requirements. But they couldn't. Why not? Because in high school they had had to make the decision to go the science-mathematics route or the humanities-social sciences route. And quite definitely, they testified, they couldn't sample or straddle—not if they expected to make the grades and get the credits needed for admission to college.

Is this division of the flock at the secondary-school level general, and is it contributing to Sir Charles Percy Snow's frightening dichotomy of "the two cultures"?

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I find it distressing that the recent editorial "Science and the humanities" should perpetuate C. P. Snow's gap between the two cultures in a manner so blatant and, indeed, Victorian. With the phrase "After the rigors of training in science, the subject content of the humanities seems hardly more difficult than a good novel," one wipes away as trivial all the nonscientific scholarship of our civilization in general and our universities in particular.

Any reasonable acquaintance with the recommended study of scientists (rather than of science itself) as a subject for humanists shows that it is not a necessary condition that there exist a type specimen or standard sample from which to proceed. One can proceed to study science from the outside (historically or philosophically), just as one can study political history without being trained as a politician, or economics without becoming a successful businessman. Indeed, one may criticize Mathewson's proposal from the other direction; he seems to be ignorant of the fact that much of what he proposes (and more) is already in being, and in process of rapid and effective extension.

There are at least nine graduate schools now offering doctorates in the history and philosophy of science (including the sociology, economics, and politics of science) and more than 30 colleges offering undergraduate instruction in this field. At Yale, courses in the history of science have become valuable supplementary fare for scientists and humanists, and history of science has a sizable research program in its own right. At Oak Ridge during June and July 1963 there will be a summer institute designed to give nonscience college teachers an opportunity to discuss these aspects of science, in the expectation that they will introduce such discussion into their own teaching programs. In these ways, it is hoped, we may at one and the same time solve the problem stated by Mathewson and help prevent the rise of another generation of scientists that can hold such an absurdly derogatory view of humanistic scholarship as that expressed in the editorial.

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Effects of Penicillin on Bacteria

The interesting and constructive paper by J. Ciak and F. E. Hahn dealing with the antimicrobial action of penicillin [*Science* **137**, 982 (1962)] states, "Lysis of *S. aureus* under the influence of penicillin has rarely been mentioned," presumably as a mode of action of penicillin or as a consequence thereof. A reference from 1957 and another from 1959 are cited.

Actually, such effects were reported, and considered a mode of action, early in the penicillin story. Bonét-Maury and Pérault [*Nature* **155**, 701 (1945)] reported that when cultures of *S. aureus* are exposed to appropriate concentrations of penicillin, "proliferation stops almost immediately, followed by slow lysis of the bacteria," and that penicillin exerts a "very powerful lytic action." A year earlier, Nitti *et al.* [*Ann. Inst. Pasteur* **70**, 80 (1944)] made a similar observation. In 1947 Dufrenoy and Pratt referred to "bacteriostatic, bacteriocidal [*sic*], and bacteriolytic concentrations" of penicillin [*J. Bacteriol.* **53**, 657 (1947)], and Pratt and Dufrenoy offered an explanation for the "extensive bacteriolysis" of *S. aureus* exposed to the antibiotic [*ibid.* **54**, 127 (1947)].

In 1949 it was suggested that one fundamental effect of penicillin is qualitatively similar in Gram-positive and Gram-negative bacteria, but quantitatively different. "The evidence indicates that penicillin affects aerobic Gram-positive and Gram-negative organisms by blocking the catabolism of nucleotides. The threshold concentra-

tion at which its effects become manifest [in the two classes of organisms] is, however, many times greater . . . with Gram-negative organisms than . . . with Gram-positive organisms" [Pratt and Dufrenoy, *Antibiotics* (Lippincott, Philadelphia, 1949), p. 214]. This view is not incompatible with the "unified hypothesis of penicillin action" cited by Ciak and Hahn as proposed by Park and Stromiger [*Science* **125**, 99 (1957)] nearly a decade later. The latter authors did, however, present precise quantitative data to support their view, whereas the earlier proposal was based on less refined data and did not pinpoint the effects on cell-wall formation.

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Therapeutic Dosage in Small and Large Mammals

The research report "Lysergic acid diethylamide: Its effects on a male Asiatic elephant" [*Science* **138**, 1100 (1962)] on the therapy of the Proboscidea contains an elephantine fallacy. In these days when certain highly organized groups are striving earnestly to legislate against animal experimentation, it is unfortunate that quite so gross an error should appear in print. The basic problem seems to be extrapolation from limited data acquired in therapy of small mammals in determining the first therapeutic dose to be used on a larger form. To my knowledge no very precise set of rules exist, but some general principles are of value.

Rule 1. If we wish to determine, from toxicity data based upon findings in the cat, a therapeutic dose safe for an elephant, our first rule is to consult a veterinarian or, if possible, an animal husbandman with experience in handling elephants. Probably the best individual is a veterinarian with experience in dosing animals in a zoological garden. Individuals experienced in human therapeutics are too much limited by their training. Their thinking is confined essentially to one species of animal, and they have no proper experience upon which to draw in trying to transfer data obtained from one species to a second species.

Rule 2. The metabolic rates, including the rates of metabolism of drugs, of two animals are related not as the weights of the animals but as their sur-