havioral articles, then by the report on "Infrared spectra of hydronium ion," followed by another of the behavioral reports. Readers whose interests are primarily physical, chemical, biological, or behavioral would then not be forced to mutilate articles of interest.

Dispersing articles on related topics throughout the issue does require readers to peruse all the titles given on the contents page, but I suspect most readers do that anyway, and dispersing related articles would allow more effective utilization of *Science* by those of us who clip and file.

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Mannerisms

Science has an editorial mannerism that kills the effect of an author's last, and preferably most important, sentence: the parenthesized number that, hunted down, gives various thanks and the abracadabra of the assisting grant. This unhappy anticlimax suggests a trombone player closing with a stuck valve or respiratory seizure. Surely necessary obeisance can be made without keying to the author's text, and irrelevant intrusion on the reader's thought.

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Theory of Enzyme Action

M. F. Perutz, in the concluding paragraph of his Nobel lecture on the x-ray analysis of hemoglobin (*1*) suggests that there may be enzymes which alter their structure on combination with their substrate, and that this might be an important factor in certain mechanisms of their activity. These suggestions are so close to the theory of enzyme action which we have been elaborating that comment seems appropriate.

Our theory postulates that contact of enzyme and substrate at the time of mixing produces, at least in vitro, an immediate and apparently irreversible change in the kind of enzyme described by Perutz. The extent of this change depends on the concentration of substrate, and its effect is to decrease the catalytic power of the enzyme as shown by the rate constant of the reaction catalyzed. Decrease in catalytic activity is not linear; the rate constant falls rapidly at first, then more and more slowly as substrate concentration is increased. Decreased catalytic activity with higher substrate concentrations is attributed to this structural change in the enzyme and not to mutual interference of substrate molecules.

This theory is based mainly on findings with several enzymes—serum and brain cholinesterases (*2*), liver and jack-bean hydantoinases (*3*), pyruvic carboxylase (*4*), and lactic dehydrogenase and urease (*5*)—catalyzing a variety of actions. In each case the progress of the reaction in any one vessel obeyed exactly the ordinary mass law equations throughout the whole period examined (often up to 80 percent of the completed reaction), if due regard was paid to the chemistry involved. For example, the rate of formation of the product of a two-stage reaction (a type common in biochemistry) does not follow first-order kinetics unless one constant is of a higher order of magnitude than the other. If, however, the initial substrate concentration is changed, the velocity constant is different, decreasing with higher substrate concentrations. This fact is obscured by the habit of plotting initial velocities ($= ka$ for a first-order reaction) against substrate concentration a; such a curve rises or falls depending on the relative rate of decrease of k as a is increased. The rate constant appears to be set for the whole period of the reaction at the moment of contact of enzyme and substrate; it does not fall off as the reaction proceeds and the substrate concentration falls. The effect therefore appears to be irreversible, but it can be repeated at any stage of the reaction by a second addition of substrate: this promptly produces a further decrease of the rate constant. Catalysis is ascribed to contact of enzyme and substrate; whether or not a "compound" is formed is largely a matter of definition, but there is an interaction leading to immediate break-up of the substrate into its products. An immediate break-up is postulated because the rate equations contain no term for the concentration of a compound which must therefore be vanishingly small.

This theory differs from the one generally accepted (Michaelis) in postulating that the rate of break-up of the enzyme-substrate compound is much more rapid than the rate of its formation ($k_3 >> k_1$) and in attributing most of the peculiarities of enzymatic catalysis to the protein nature of the catalyst.

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References and Notes

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3. G. S. Eadie, F. Bernheim, M. L. C. Bernheim, *J. Biol. Chem.* **181**, 449 (1949).
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Cultural Schism

A strenuous public debate does not necessarily denote a cultural schism that T. Page [*Science* **141**, 390 (2 Aug. 1963)] seems to think exists between the proponents of a much stronger space program and their colleagues who are not so disposed. Rather, the debate suggests that the opposing groups are in direct, eye-to-eye contact. In this light, a three-culture extension of Snow's two-culture model that Page would impose is not very meaningful or useful. As a hint that his assertion of a singular isolation of space engineers and scientists will not stand close scrutiny, it is a fair guess that the general benefits (listed by Page as "communication bridges") and the myriad scientific gains to be reaped by the space effort are appreciated by most scientists and engineers. A value of Snow's model was to indicate that a comparable appreciation and understanding of scientific progress has not been shared by the overall intellectual community. Although there may be value in Snow's calling attention to this deep and pervading rift, to extend his model to account for a difference of opinion on the national space policy is quite beside the point but certainly tends to becloud the central issues. The opposition to the relatively rapid growth of the space effort does not seem to take an "anti-science" form, but rather asks for a more balanced attitude toward the overall economic-scientific complex of national interests.

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