the vertebrate brain. What we intended to suggest is that those psychological characteristics are perhaps built of well-formed behavioral bricks already having their origin in the most primitive central nervous systems—for example, that of the planarians.

Being for controlled experiments is like being against sin. It is not, however, entirely clear to us what Davenport means by "controlled experiment," "physiological interpretation," and so on, and since one of us is a physiologist (the other is a psychologist), the communication failure is not entirely due to our lack of familiarity with and appreciation of physiological methods. If he means we should confine ourselves exclusively to notions of "excitation," "inhibition," tropism, and reflex, then I must confess not only a lack of sympathy for such chauvinistic nonsense but a reasonable certainty that the investigators of invertebrate behavior who do have simply not been observant.

Davenport must know that the reports in *Science* are seldom allowed more space than the equivalent of 1200 words for text, figures, everything—a limitation which prohibits review of the literature. Hence the omission of J. Z. Young's important studies, as well as those of Von Frisch and many others.

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Science and Democracy

A recent editorial in *Science* [**136**, 231 (20 Apr. 1962)] raises again the frequently discussed question of whether democracy necessarily provides the best soil for science. A devil's advocate could make a good case for answering "no"; and an impartial jury, faced with the question, would probably bring in the Scottish verdict of "not proven." Indeed, if such a proposition had been put forward a century ago almost any informed person would have answered in the negative. In the development of basic science the democracy of the United States, preoccupied with practical needs, lagged far behind the mon-

archical countries of Europe. As Dupree (*1*) has noted, Asa Gray, for instance, believed that only a monarchical government could effectively support science. "Neither our Congress nor our executive department can be depended on for attending to any such thing wisely or honestly," Gray wrote in a letter to Joseph D. Hooker on 3 June 1866.

American scientists today in general believe that science is good and also that democracy is good. It is an easy jump from that belief to the conclusion that the one is therefore good for the other. Our natural predilections favor such a view; but this very fact should put any critical scientist on his guard against accepting the proposition too readily. A few glimpses at the past might provide strong evidence to the contrary. During most of the 18th century, under the very undemocratic governments of Louis XV and Louis XVI, France led the world in science. Although Lavoisier was executed during the Revolution, French science survived and flourished vigorously under the Napoleonic dictatorship. Napoleon himself gave active encouragement to science and took a group of distinguished scientists and scholars, including Monge and Berthollet, on his Egyptian expedition to carry on researches. Likewise, Imperial Germany from 1870 to 1914 held a position of world leadership in science and learning, yet it was certainly no democracy. One could cite further instances, but these may suffice for illustration.

More important, probably, than any particular form of government was the European tradition that rated intellectual achievement and the advancement of learning as being among the supreme values in the life of man. This tradition was not bounded by national frontiers; it persisted through the upheavals of war and revolution. Harsh governments sometimes imposed rigid limits upon the freedom of inquiry and discussion, when political issues were involved, but the area of intellectual freedom was still very broad. Modern science is primarily a European creation; one need only look at a list of the leading American scientists today, in almost any field, to see how many of them were born and educated in Europe.

Obviously, some kinds of government are inherently inimical to science. German science slowly disintegrated during the frenzied fanaticism of the Nazi regime, which was rooted in a deep irrationalism that was fundamentally hostile to science. Likewise it

is clear that Soviet science, and biology in particular, was heavily damaged by Stalin's assault on genetics. I see no evidence, however, on the basis of the historical record up to this time, that science necessarily flourishes better under a democracy than under an authoritarian regime, provided the latter is reasonable enough to allow investigators to pursue their researches without interference, in the field of their interest. I doubt whether the imagination of Soviet physicists and chemists in attacking scientific problems today is significantly inhibited by the fact that the free play of thought and discussion in the domain of the social sciences is sharply restricted in Russia. The Russian biologists may suffer more than the physicists and chemists, since their field of research is closer to the social sciences, but here the wounds suffered by Soviet biology in the Lysenko controversy have probably been a more important factor.

The spirit of independent inquiry, which is essential for every scientist, sometimes spreads from the particular area of his research interests and becomes embodied in an independent and critical attitude toward the problems of the world in general. Hence, one may cherish the hope that totalitarian governments, which today are compelled to promote the development of science in order to maintain their position as world powers, will eventually become permeated by more liberal thinking on the part of their scientists, who may gradually come to assert their intellectual independence in wider spheres of thought and action. This, however, remains a hope, fostered by our own interests and predilections, not an established fact.

It has indeed been demonstrated in our time that the government of a democracy, such as that of the United States, can effectively foster the development of science on an unprecedented scale. In this sense experience has refuted the gloomy forebodings of Asa Gray, quoted in the first paragraph of this letter; but this is obviously no proof that a democratic society can promote the growth of science more effectively than any other.

The subject deserves more thought and research than has been given to it, and these brief remarks are offered largely in the hope that they may stimulate historians and social scientists to inquire more deeply into the relations between the growth of science and the form of government and society in which the scientists live.

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1. A. H. Dupree, *Science in the Federal Government: A History of Policies and Activities to 1940* (Harvard Univ. Press, Cambridge, Mass., 1957), p. 156.

Proving Grounds in the Behavioral Sciences

Two sentences from a recent issue of *Science* [**135**, 503, 505 (1962)], one from the editorial "Prophecy fulfilled" and one from the article, "A scientific society—the beginnings," by Glenn Seaborg (neither sentence especially germane to the principal theme of either author), plus a sentence from the lead article of a later issue, "Strengthening the behavioral sciences" [**136**, 233 (1962)], places in juxtaposition factors which I believe underlie a major dislocation in the "mix" of American research and development.

The fragment from the editorial is: "the theory-to-practice sequence is not as rigorous as is common in the physical sciences and engineering." The