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Cover: The opening near Moscow of a 25-megawatt power station that generates electricity by magnetohydrodynamic effects of hot gases was front-page news in Pravda last December. Work in the United States is not so far advanced. See p. 138. (Clipping courtesy William D. Jackson and AVCO Everett Research Laboratory)

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**Advertising** Scherago Associates, Inc.  
11 W. 42nd St., New York, N.Y. 10036  
Fred W. Dieffenbach  
Sales Director

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Subscription Department  
231 West Center Street  
Marion, Ohio 43302

Subscription rate: 1 yr., \$10; 2 yrs., \$18; 3 yrs., \$25. (Add \$2 a year for Canada and Mexico, \$3 for all other countries.) Change of address: Four to six weeks' notice is required. Please state exactly how magazine is to be addressed. Include zip code.

Printed in U.S.A. Second class postage paid at Washington, D.C. Established as Science News Letter® in mimeograph form March 13, 1922. Title registered as trademark U.S. and Canadian Patent Offices.

Published every Saturday by SCIENCE SERVICE, Inc., 1719 N St., N.W., Washington, D.C. 20036. (202-785-2255). Cable: SCIENSERV.

august 26, 1972

## COMMENT

### What is science?

The scientific controversy over the validity of a research group's work on scotophobin, the substance they are trying to prove is capable of the chemical transfer of learned behavior from one animal to another (SN: 8/12/72, p. 100), carries some lessons for scientists and nonscientists alike.

For scientists, it is a reminder that on controversial topics, the road to scientific acceptance is long and arduous. There is no guarantee the journey will ever be successfully completed.

For the general public, it should help emphasize that science is a dynamic process, an imperfect and sometimes tumultuous search for answers, rather than a static collection of agreed-upon truths. The general public has many misconceptions—perhaps a total ignorance—about the nature of the scientific process, and many persons concerned about the relations between science and society have expressed concern about that situation. The Physics Survey Committee of the National Academy of Sciences (SN: 8/12/72, p. 101) voices regret that not even science teachers understand the scientific process: "The typical U.S. teacher . . . is not well equipped to guide his pupils in learning that science is more than a collection of facts to be memorized or techniques to be mastered but is instead an inquiry carried on by people who raise questions for which answers are unknown and who have gained confidence in their ability to reach conclusions, albeit tentative ones, through experiment and careful thought sharpened by the open criticism of others." The committee blames not the science teachers but the educational system in which they were trained.

But a good share of the blame rests with scientists themselves. Until recently many segments of the scientific community tended to adopt a stance of self-righteous High Priestism toward the general public. One was not to understand how scientists arrived at their answers, one was only to receive their pronouncements with thanks and a measure of awe. Scientists allowed the misconception to grow that science was the source of final answers rather than merely a continual process of asking questions and searching for answers. The difference may not seem important, but it relates in important ways to mistaken public expectations of science. The public was led to expect too much from science; then when science could not solve all major problems (as has become so evident in the United States in the past decade) the public became disenchanted and in its disappointment perhaps overreacted toward a negative view of science.

A related problem has been science's traditional concern with presenting a united front to the public, with concealing from public view arguments, controversies, personal ambitions and any hints of competitiveness in scientific research. This helps explain why James Watson's book, *The Double Helix*, was such a phenomenon a few years ago. It broke the traditions of the club and for one of the first times revealed that scientists have all the passions, foibles and ambitions of other human beings. Of course, that involves the informal part of the scientific process. The formal part—hypothesis, controlled experimentation, criticism of papers by referees, publication, peer review, attempts to duplicate or disprove results in another laboratory—are integral to the nature of science. Most scientists would probably now agree that the better the public understands how these things work, the better off science will be in the long run.

\* \* \* \*

As for the scotophobin controversy specifically, the journal *NATURE* and all persons involved are to be commended for the way the research report was handled. Published were the report itself, a detailed criticism of it by the referee, a rebuttal by the report's authors, and a note of explanation by the editors. (The only quibble is that 17 months elapsed between submission of the paper and this flurry of publication.) Scientists and the public should both benefit from the perspective thus given on the subject. It will be interesting to see whether further research on scotophobin will allay the criticisms and lead to wider acceptance of the work.

Kendrick Frazier