

Letters

No Research Strike at M.I.T.

As signers of a faculty statement which was reported in the News and Comment section of the 24 January 1969 issue of *Science*, we find that your headline referring to the action planned by a group of scientists at M.I.T. as a "strike" is misleading. It is not an action directed toward M.I.T.

The statement issued by this group declares that they intend to halt their research activities for a day and devote this day to a public discussion of problems and dangers related to the present role of science and technology in the life of our nation. The fact that no research work will be done by the participants during this day is a gesture meant to underline the importance of the problems involved.

BORIS MAGASANIK

JOHN ROSS

VICTOR WEISSKOPF

*Departments of Biology, Chemistry,
and Physics, Massachusetts Institute
of Technology, Cambridge 02139*

Thermal Pollution of Cayuga Lake

Viewed against the background of the prodigious growth expected in the nuclear power industry and its requirements for cooling water, the pamphlet on thermal pollution of Cayuga Lake prepared by Eipper and his associates is an important attempt to educate and to arouse public concern (8 Nov., p. 649). Here in Maryland newly formulated laws require public hearings and specify that the industry must obtain a certificate of public convenience and necessity *prior* to site acquisition and preparation. This will at least provide the opportunity for opposing viewpoints to be heard and, hopefully, will end the current practice of seeking water use permits after site acquisition and preparation, when a denial of the permit is no longer a real possibility. Similar legislation is evidently needed in New York.

For all of its value, there is much that is speculative in the Eipper pam-

phlet, and I am particularly skeptical of the claim that eutrophication is irreversible. This may be true of the natural process, but there is considerable evidence that it is not true of cultural or man-made eutrophication (1). . . .

D. HEYWARD HAMILTON

*Chesapeake Biological Laboratory,
University of Maryland, Solomons
20688*

Reference

1. A. D. Hasler and B. Ingersoll, *Natur. Hist.* 77, 8 (1968).

Like Eipper, I am concerned about the potentially deleterious effects. . . . However, as a scientist I prefer to be as objective as possible and therefore I agree with Allee, who felt that the Cornell University Water Resources Center should study the total possible effects of thermal discharges to Cayuga Lake. I applaud Allee and his colleagues for the "academic detachment" that *Science* noted in their prospectus for research on the ecological impact of the nuclear plant on Cayuga Lake. . . . Accordingly, I object to the insinuation that the Cornell center entered into this kind of research with New York State Electric & Gas Corporation funding because federal funds were going to be rather short, and the center, in order to make the project attractive, yielded to the power company's interests rather than to the needs of a "long-term academic study."

The center, like other university water research centers, has recognized the need for facts on which to base interpretations that may result in legislation and regulations. If these facts are not available, and if state or federal regulatory agencies are unwilling or unable to fund research projects that would obtain such facts . . . then the center has no alternative other than to seek funds from one or both of the parties maintaining opposing views (the power company or the conservationists), to support a project that will uncover this kind of information. If the project must be modified so that the potential funding source can sell it to its board of directors, this is understandable and permits the work to

be done. It certainly does not give the reporter license to imply that this work would therefore be slanted in the direction of benefiting the funding agency—although I admit that this is always a possibility, whether the funding agency is a power company, or one of the federal or state agencies, or even a conservationist group. . . .

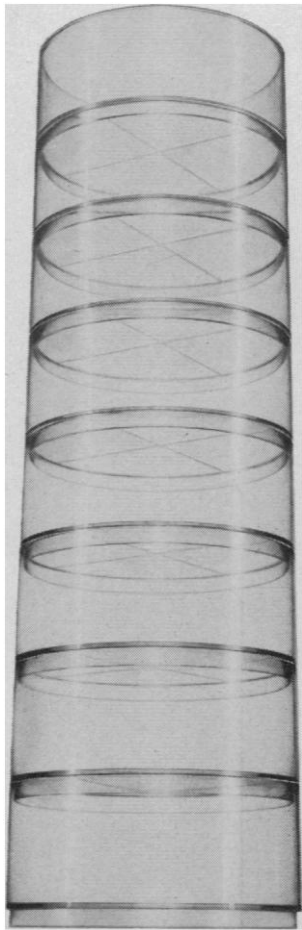
ALLEN F. AGNEW

*Water Resources Research Center,
Indiana University, Bloomington 47401*

These problems are not peculiar to Cayuga Lake, but are also acute in other areas such as the Columbia River and the Great Lakes. . . . If the heat supply were evenly distributed over an entire lake, changes in the thermal regime are rather easy to predict: lake evaporation would increase in direct relation to additional heat supplied and the temperature of the water surface layer would increase to a level which would produce additional evaporation. Because of the great diffusion of a limited source, the ecological effects of evenly distributed heat would be minimal and it would be difficult to say whether they are detrimental or not. In reality, introduced heat is not evenly diffused throughout a water body. Investigations in the Great Lakes indicate that effects of added heat are noticeable only in the vicinity of a heat source and that the heat distribution pattern depends mostly on the current pattern. Concentration of a large heat supply within a rather limited area will create pronounced local effects. However, these effects would not necessarily be detrimental, but could be used to advantage. Considering the geographical location of the Great Lakes and Cayuga Lake where homes require heat about 9 month per year, one must wonder if it would not be feasible to utilize that free heat to benefit the environment instead of wasting it in cooling towers. With little imagination one can list at least half a dozen ways:

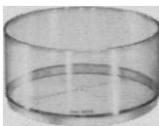
1) *Heated swimming pools.* Cleveland, for the purpose of controlling water quality, built a large natural swimming pool by enclosing a portion of Lake Erie. Based on instantaneous success, plans are under way to build a second, improved pool.

2) *Water farming.* The best fishing grounds in the oceans are usually around upwelling areas where deep water, rich in nutrients, rises to the surface. Discharge of heated water in deeper portions of a lake would produce an upwelling and create condi-



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tions which would support large fish populations introduced to fit the new environment. The introduction of Coho salmon into the Great Lakes has had amazing success and has been a tremendous boon to the local economy.

3) *Wintering for waterfowl.* Ice-free areas in a lake during winter months would concentrate the waterfowl of the entire lake, increase survival, and create tourist attractions.

4) *Deicing of waterways.* In the Great Lakes the harbors and their approaches are ice-covered long before ice extends into the deeper portions of the lakes. Keeping these critical areas free of ice by discharging heated water through perforated pipes on or near the lake bottom would prolong the navigation season.

5) *Water quality improvement.* One could envision the use of excess heat to purify water by processes similar to those used in desalinization.

6) *Industrial and domestic usage.* Almost unlimited applications could be considered, some from a theoretical, and others from a practical standpoint. Examples can be mentioned, such as hydronic heating of homes and offices, and systems for keeping streets and highways free of ice and snow.

The need for positive solution of problems related to nuclear power sources requires a national institution which would not only conduct research but would also build pilot installations and advise power companies on their specific problems. Such an institute could be supported by the power industry, if every licensee were required by law to contribute to it.

"Thermal pollution" is not the most desirable name for this subject because of the connotation attached to "pollution." "Thermal enrichment" was recently proposed as a substitute. However, if enrichment would imply only improvement of water quality, then "thermal change" might be more appropriate.

L. BAJORUNAS

17689 Goldwin Southfield, Michigan

Freedom To Breed

"The tragedy of the commons" by Garrett Hardin (13 Dec., p. 1243) neatly misses the mark, ironically exemplifying the contrasting view.

If each person in a collection of rational individuals is intelligently motivated to pursue a course leading to col-

lective tragedy, then human experience teaches that tragedy is prevented by the emergence of a social order requiring the submission of individual desires for the common good. This has been the fundamental motivation for the evolution of government.

Hardin calls for a party external to society to regulate individuals' activities. He is in fact playing the role of a rational member of the group by expressing a need for collective behavior.

JORDAN D. LEWIS

Battelle Development Corporation,
505 King Avenue, Columbus, Ohio

Hardin's skill in the presentation of insidious arguments is awesome. Before reading this article, I would have admitted that a gunfight between cops and robbers illustrated the meaning of mutual coercion. Now I am convinced that the tribal immolation of a tribesman, however unwilling a victim he may be, is an instance of mutual coercion, mutually agreed upon by the majority of the people affected. By his very membership in the tribe, the victim has mutually agreed with his fellows in his coerced self-sacrifice. We may be close to solving the dilemma of dissent within our society. We need not actually forbid a citizen to dissent as long as he wants to; we need merely make it increasingly expensive for him to do so. We need not prohibit dissent, but only mutually agree upon what carefully biased options to offer dissenters. Dissenters could be licensed on payment of fee in money or blood, a truly new solution to a new problem.

ROBERT E. DRURY

New York State Agricultural
Experiment Station, Cornell
University, Geneva 14456

... Hardin, like most advocates of coercion or other negative sanctions, has a one-sided view of human history. Voluntary checks on natality are a universal culture trait, and are usually intensified when density becomes oppressive. The delay in the operation of these voluntary population balancing factors, which has led to our current population growth rates, may well be associated with political and economic colonialism.

"Technology" by itself will not solve our difficulties (and no one has said that it would), but the coitus-independent methods of birth control and new agricultural developments have vastly improved our chances to surmount them, if we would only make them

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