Letters

Remarkable Crime Bill

One can gain an idea of the hysteria into which the Administration is successfully driving the Congress from the appallingly loose language of portions of the recently enacted Organized Crime Control Bill. The portions of the bill that I have in mind are those added by the Administration at the last moment, after all hearings had been completed. This extraordinary procedure brought irritated comments from Emanuel Celler, chairman of the House Judiciary Committee, directed not against the content of the addenda, but only against this assault on his committee's prerogatives. The additions to the bill were incorporated essentially without change.

Section 844 (f) of the bill adds nothing to existing legislation or executive orders and is remarkable only by including in a list of property owned or leased in whole or in part by the federal government "any institution or organization receiving federal financial assistance." That, of course, brings under federal jurisdiction almost every institution of higher education in the country. The matter specifically involved is malicious damage or destruction, real or attempted, of personal or real property "by means of an explosive."

Section (g) reads "Whoever possesses an explosive in any building in whole or in part owned, possessed or used by, or leased to, the United States or any department or agency thereof, except with the written consent of the agency, department, or other person responsible for the management of such building shall be imprisoned for not more than one year, or fined not more than $1,000, or both."

Section (j) defines "explosive." In addition to various things commonly recognized as explosives, it includes "any chemical compound, mechanical mixture, or device that contains any oxidizing and combustible units, or other ingredients, in such proportions, quantities, or packing that ignition by fire, by friction, by concussion, by percussion, or by detonation of the compound, mixture, or device or any part thereof may cause an explosion." Like a package of matches. Like illuminating gas. Like the gasoline in your car. Like rubbing alcohol. Like most of the solvents in any research laboratory, or teaching laboratory in chemistry, biology, biochemistry, physics, engineering—what have you?

This is what President Nixon plans to hire 1000 new FBI agents to enforce.

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Eutrophication—Key Elements

Contrary to the assertion in Abelson's editorial "Excessive emotion about detergents" (11 Sept., p. 1033), the attack on phosphates in detergents by the House Subcommittee on Conservation and Natural Resources, of which I am chairman, is not based on the "hypothesis that phosphates are the crucial nutrient that determines the magnitude of algal blooms." We think a search for the "crucial nutrient" in excessive algal growth will never be successful. Algae require at least 15 elements, in addition to water, to sustain their growth. The element that at a given time is in shortest supply relative to the algae's need for it limits the growth of the algae. But, to control algal growth by nutrient removal, it is not necessary to know what this limiting element is. If the available supply of *any* nutrient element is choked off to a low enough point, that element will become the limiting one.

The report prepared by my subcommittee urges control of algae by phosphorus deprivation because "our technology is strongest in the area of removing phosphorus" (*1*, p. 7). It does not make the suggestion because phosphorus is more, or less, a "crucial" element than carbon in the nutrition of algae. None of the material we have seen suggests that we have the capability of depriving algae of their carbon supplies, especially their supplies of carbon dioxide in the air.

We have never stated that elimination of phosphates from detergents would "solve" the eutrophication problem. We also urge better sewage treatment and control of industrial and agricultural wastes (*1*, p. 44). But it stands to reason that with detergents contributing between 28.5 and 70 percent of the phosphorus input to many of America's waters, eliminating phosphates from detergents would be a giant step toward retarding eutrophication (*1*, p. 12).

Do you really know that "In most drainage basins of the country no serious problems arise from detergents?" We had time to investigate only two basins, the Great Lakes and the Potomac, in our study which extended over several months. We found serious eutrophication problems in both, and we found that detergents were deeply involved. Vollenweider (*2*, p. 17) calls the problem of eutrophication worldwide. Excessive emotion about detergents appears in the propaganda of the soap and phosphate lobbies, not in our report.

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References

1. *Phosphates in Detergents and the Eutrophication of America's Waters*, House Committee on Government Operations, House Rept. 91-1004, 14 Apr. 1970 (Government Printing Office, Washington, D.C.).
2. R. A. Vollenweider, "Scientific Fundamentals of the Eutrophication of Lakes and Flowing Waters, with Particular Reference to Nitrogen and Phosphorus as Factors in Eutrophication," OECD Report DAS/CSI/68.27 (Organisation for Economic Cooperation and Development, Directorate for Scientific Affairs, Paris, 1968).

. . . In the control of artificial eutrophication the key element is that which can be limited so as to cause a satisfactory decrease in the abundance of nuisance-producing algae. In many places phosphorus can be so limited with beneficial effects, but not carbon.

Much of the disagreement is only apparent, generated by the fact that the Carbon People insist on talking about the general mechanism of control of seasonal changes in abundance of phytoplankton, while the Phosphate People want to talk about what we can do to improve artificially eutrophicated lakes. Much of the controversy is not about data or even their interpretation, but results simply from the fact that people are talking about rather different things. . . .

As readers of *Science* know, Lake Washington is the site of an experiment in this field (*1*). Diversion of treated sewage was followed by a much greater

decrease in the dissolved phosphate supply than in that of nitrate, carbon dioxide, or alkalinity. The abundance of algae has decreased in close proportion to the concentration of phosphate.

The real question that should be debated is not what is the key element that regulates algal blooms, but what should we do to limit most effectively the input of concentrated sources of nutrients to lakes? Elimination of phosphorus-containing detergents would make a great difference in the amount and concentration of phosphorus entering lakes. While it would leave important sources of concentrated sewage phosphate available, detergents have made sewage very much more effective than it was formerly.

Ideally, all sewage entering lakes would be treated in such a way as to remove phosphorus in those large geographical regions where phosphorus is not naturally present in excess. But even if the technology were adequately developed, it would take a very long time to finance and build the facilities and they would be costly to operate. In the meantime, lakes would continue to deteriorate.

It was possible to divert the sewage from Lake Washington without creating a similar problem elsewhere, an option not open to many communities. Where such diversion is not possible, lake eutrophication problems will have to be solved by controlling the character of sewage effluent, either by treatment or by controlling what goes into the sewage. Even if control of detergents by itself is not enough to solve all eutrophication problems, it could be a very helpful part of a control program.

The decisions to be made must balance a complicated set of short- and long-term effects. If the disadvantages of the phosphate ban overweigh the advantages for the reasons outlined in Abelson's editorial, the matter should be decided on that basis, not by obscuring the real effectiveness of detergent phosphates.

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Reference

1. W. T. Edmondson, *Science* **169**, 690 (1970).

. . . There are three specific reasons for attacking phosphates in detergents as part of an overall program of phosphorus control. In the first place it would achieve a more rapid removal of 50 to 70 percent of the phosphorus now present in sewage effluents than would be possible by any other means. (As Congressman Reuss put it, it is easier to do something about three major detergent manufacturers than about the 200 million manufacturers of phosphates in physiological wastes.) Second, there would be a substantial and *permanent* reduction of overall treatment costs for phosphate removal at sewage treatment plants (an estimated saving of $22 million per year calculated on the basis of alum treatment in the basins of lakes Erie and Ontario alone). Third, it would eliminate 50 to 70 percent of the phosphate generated in isolated dwellings and small communities, situations in which any other kind of control would be difficult if not impossible to achieve.

Abelson says that the elimination of phosphates from detergents would not "solve" the eutrophication problem. I agree, but there is no factual basis for anyone suggesting that it would not help. In a like manner, I doubt that the goal of 80 percent removal of phosphates at sewage treatment plants without detergent control would "solve" the eutrophication problem; nevertheless, it also would help. The effective cure for cultural eutrophication requires the combined removal of phosphates from detergents and as much of the remainder in municipal sewage as it is technologically feasible to remove. If we call these three solutions A, B, and C, the effect would be to reduce a city of one million inhabitants to about 400,000, 200,000 and less than 50,000, respectively, in terms of the phosphate generated. In areas with animal feedlots or intensive farming, additional controls, in part educational, may be required.

By reciting some of the unusual limnological claims made in the article in *Canadian Research & Development* Abelson more confused than advanced learning. A half century of experience with a large number of waters throughout the world has shown that carbon rarely limits the overall extent of plant growth *in the aquatic environment.* In saying that massive algal blooms have occurred in lakes containing very little phosphate one should realize that, like the empty dish after a good meal, lakes are low in dissolved phosphate when algae bloom because the phosphate is in the algae. Also, when the concentration is low it is the rate of supply that counts. With a continued influx of phosphorus and nitrogen compounds from human wastes an algal bloom will be perpetuated; but with phosphates removed this would in most instances no longer be the case.

In terms of the phosphate question there is merit in treating drainage basins separately as Abelson suggests; but the overall policy in regard to detergent phosphates may be more dictated by industry and the ease of governmental control. A similar question arose 6 years ago in relation to nonbiodegradable surfactants in detergents. The solution adopted by industry was international.

Finally, problems of eutrophication have been increasing exponentially in recent decades. Although we do not have exact information on how many waters may enter a critical phase during the next 5 or 20 years, we do know that with continued growth of human populations and associated technology we cannot extrapolate linearly from the past and present. If steps are not taken soon to alleviate the problem, we may find ourselves by the year 2000 in the middle of an algal bowl, with effects on water use comparable to those of the dust bowl on land use in the first third of the century.

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Molecular Biology: Peroration or Obituary

Although my wife has often pointed out that my speeches might improve if they were set to music, I have yet to act on her suggestion. Hence, I was rather puzzled at first by C. G. Kurland's opinion ("Ribosome structure and function emergent," 18 Sept., p. 1171) that the "peroration that Stent [*Science* **160**, 390 (1968)] has recently intoned for molecular biology may seem somewhat premature." Kurland, I thought, must be confusing my article with Joel Herskowitz's "Double talking helix blues" (recording issued by Vertebral Disk Co., Chicago, Ill.), although I wondered why he should find that long-overdue art form "premature." But on reading further his remarks concerning my views I realized that Kurland probably meant that I delivered a premature *obituary* for molecular biology.

Well, now that I learn how Kurland's