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Dear Sir:

The open letter on experiments with artificial genetic material published by the Committee on Recombinant DNA Molecules of the National Academy of Sciences (Berg, P., et al., Proc. Natl. Acad. Sci. U.S. 71, 2593-2594, 1974) seems to presage a new endeavor to regulate and restrict genetic research. In the first public discussions of this letter (Science 185, 332-334, 1974; Nature 250, 278-280, 1974) certain of its possible consequences seem to me to have been slighted. The letter calls for: a voluntary moratorium on two types of experiments, ones creating novel bacterial plasmids and ones creating hybrids between oncogenic viruses and bacterial plasmids; the creation of an N.I.H. committee to "devise guidelines" for investigators working with these molecules; and a meeting to be convened in 1975 to debate the question still further. This appears to me to be an open invitation for the establishment of a burgeoning bureaucracy concerned with monitoring and regulating genetic experimentation. Such an outgrowth will of course subsist parasitically on the body of U.S. biological science as a whole. In medical research we have seen something similar during the last decade in the growth of agencies to monitor research involving human subjects. If anyone thinks this trivial, let him ask his clinical colleagues about the rigmarol now required to obtain a drop of serum or a speck of already excised tonsil for experimental purposes. There has been an entirely appropriate concern in certain parts of the public sector that resulted in the imposition of many well-intentioned rules and regulations for the protection of the rights of human subjects in medical experiments, but in practice over the years these regulations have multiplied and ramified to the point that they are always troublesome and

very frequently inappropriate to the case. This letter is offered in the spirit of a simple query. Do the ends obtainable justify setting up another instance of this sort of costly and cumbersome bureaucratic machinery?

It takes a great deal of conceit to believe that, intentionally or unintentionally, we biologists can assemble segments of DNA more fearful than those that occur naturally. Infectious disease experts are observing the rapid evolution in nature of plasmids conferring almost all conceivable multiple drug resistance and virulence factor combinations. As far as I can see, any combination of genes that can thrive in the real world has an excellent chance of assembling itself naturally. Fortunately, we have been able to devise rather effective and simple means to study these agents in the laboratory and dispose of them safely. Why cannot the same measures we depend on to save us from dissemination of known or suspected natural pathogens--some of which are grown in large quantities for vaccine production--be relied upon for protection from artificial ones assembled in laboratories? Naturally occurring agents are often better shielded by spores, capsules, capsids and the like than ones constructed by even the best DNA chemist. Man-made plasmids must make their way in nature either pitifully naked or housed in a laboratory strain of E. coli. I am unimpressed by the argument that E. coli as a natural human commensal is especially likely to be made unwittingly into a malevolent agent. I strongly suspect that the E. coli strains molecular biologists use are so degenerate from their soft life on nutrient agar slants that they would have a tough time surviving in the real world of the intestine, even without the handicap of carrying a man-made plasmid. The chance of these strains transmitting their plasmid to a more vigorous, feral relative before perishing seems to me remote; in any

case, the techniques of containment and disinfection are legion, and happily so well known and available to microbiologists that the creation of an N.I.H. bureaucracy to oversee their use would seem an exercise in redundancy. We already have "biohazard" regulations aplenty, and despite the multitude of opportunities, escape of pathogens from laboratories is an extremely rare event.

Nevertheless, much as the fear of "potential risks" in man-made plasmids seems to me to exemplify unwarranted paranoia and uncertainty more than real danger, it is apparent that a group of 11 (or more) leading scientists feels serious concern that, through naivety, some scientist is likely to get us into trouble. Rather than raise the specter of moratoria of any sort, and/or of bureaucratic supervision, conditions which have never been associated with good periods in science, would it not have been wiser to say the following:

> Let each scientist decide at the outset of his experiments whether he would care to expose himself, or better, his child, to the newly assembled "agent". If not, let him learn and use the techniques of containment needed to control such agents. Let him be encouraged to describe in detail these procedures in his proposals for funding and his publications. In many cases some improvement of facilities for containment of potential pathogens, not necessarily elaborate, and some training in handling infectious agents may be desirable.

I've little doubt that, with these provisos, any damage done to our species by careless or heedless researchers would be trivial in comparison

with the seriousness of the loss of freedom of inquiry and useful resources that will likely result from the committee's approach if it is not immediately and vigorously opposed by the scientific community.

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