

December 3, 1953

Mr. Arthur L. Davis
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Dear Mr. Davis:

Your letter of October 14, concerning which a post card was sent to me recently (recently returned by me), would seem to require some reply from me, and I judge that you have been concerned because no reply was forthcoming. Unfortunately, I have been abroad since the end of September, and, while various members of the staff have handled most of the matters that came up in my absence, no one undertook to deal with your suggestions. I can understand their reluctance to do so when I consider my own reactions to them, since I'm afraid I do not understand just what you are getting at.

As it seems to me, investigators are attempting to get together certain facts about air pollution on a fairly broad base. Some have tried to draw conclusions from information that can only be regarded as fragmentary. In my view, at present, no particular profit will come from employing various means of expressing these fragmentary data. While I welcome and encourage new ways of looking at the matter, I cannot escape the feeling that what we require is not more theory, but more facts.

There are several matters in your observations on which I may comment.

1. I don't believe that there is any real virtue, from the aspect of accuracy, in expressing the concentration of air-pollutants in terms of 10 cubic meters of air, especially in community atmosphere, since the figure at best is inaccurate in its relationship to an 8-hour day, and since it has no meaning in relation to the hours of the day in which one may be breathing community atmosphere. It makes just one more arbitrary unit to explain to non-physiological technical people. It is better, I believe, for all purposes, to use a conventional expression which can be understood by every one at sight. There is some justification, in tradition and perhaps also in concept, for adhering to the 10 cubic meter standard in strict relation to occupational exposure, but even this, in terms of accuracy, is a dubious procedure, since it introduces one additional error into the pattern of individual exposure. I am sorry that the idea was ever introduced into practice.

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2. I do not see the desirability of expressing the concentration of materials in the atmosphere in terms of molecules, if for no other reason than that (1) it gives a false sense of precision, and (2) it implies that the molecules are separate entities which, in the case of highly associated compounds, is not true. I think it better not to go beyond the expression of concentration in simple volumetric, weight-volume, or weight-weight terms.

3. I distinctly do not like the idea of considering the toxicologic significance of the atmospheric concentration of elements or compounds in terms of the estimated numbers of the cellular units of the animal organism which is subjected to exposure. The physiologic implication of such a procedure is misleading, in that the materials are rarely distributed evenly, or in any approximation to uniformity, in the various tissues and fluids. Some of the materials never penetrate into any cell, and their course in the body is such that many of them never have access to many of the body cells. It is a function of toxicological investigation to find out where and by what means the various substances exert their influence.

4. The concept of the influence of toxic materials on enzyme systems is, of course, time-honored, and it has been supported well by quite a number of investigations. (I believe there is no evidence that lead inhibits enzyme systems in which -SH groups are concerned. Certainly this is not its important point of attack.)

5. In the matter of the physiologic effects of various concentrations of chlorides and fluorides, such as those contained presently in community supplies of drinking water, whether natural within limits, or added within presently approved limits, the evidence of experience and investigation is much too comprehensive to be shaken by implications based on such calculations as you have made. Historically, man, living on this planet, has always had to deal with chlorides and fluorides within certain limits of concentration. There is not the slightest reason, at present, to doubt that the introduction of fluoride into the drinking water, within the limits recommended and controlled, is both safe and advantageous to man. As to the chlorides, the situation is even clearer, in that it is difficult to administer a toxic amount of chloride to a healthy animal, including man, whereas the presence of chlorides within the body is essential, and the normal range of the concentration is quite appreciable.

6. One of the most significant matters, with reference to the toxicology of air pollution, is that of the combined effects of many substances to which the organism is exposed simultaneously or serially. Until something more is known here, we shall have to indulge in considerable speculation. Another factor in the matter is that of susceptibility. We shall have to work out what is meant, physiologically, by such susceptibility.

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I should not wish to convey the idea that I am opposed to chemical and physiological speculation in this field of investigation. Rather, I have attempted to suggest that we need not make the speculation too complicated until we have accumulated a greater body of simple facts based on observation and investigation. You refer to the inability of physicians to diagnose and treat fluorosis. May I point out that this is not surprising, since acute fluoride poisoning is quite rare in the experience of physicians, while chronic fluorosis is practically non-existent as a clinical entity.

Cordially yours,

Robert A. Kehoe, M. D.

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