Angeles County Heart Association has, for a number of years, been carrying out the activities recommended by the report and has been a leader in analyzing and applying the best management and community-organization principles to operations in the health field. We have regular agency evaluation and have pioneered in the application of uniform accounting principles. I know also that we are not unique in this respect. We welcome increased interest in the very complex problem of finding ways to achieve scientific management and administration and still maintain "voluntary" efforts.

I do wish to comment that many of the observations of the report have the limitations of generalizations and that some are of questionable validity. Uniform accounting may be convenient for research investigators but is not essential for honest reporting of different programs of different organizations. This is certainly a more complex problem than many amateur administrators realize.

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Pitfall

Ann Roe, in her recent article, "The psychology of the scientist" [*Science* **134**, 456 (1961)], discussed at some length the personal commitment of a scientist to a hypothesis he has formulated. A warning of this emotional pitfall has nowhere been better expressed than in the words of Francis Bacon (in his *Novum Organum*): "In general let every student of nature take this as a rule—that whatever his mind seizes and dwells on with peculiar satisfaction is to be held in suspicion; and that so much the more care is to be taken, in dealing with such questions, to keep the understanding even and clear."

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Fluoridation

Some of the letters on fluoridation (*1–3*) which appeared in response to Levine's thoughtful note (*4*) merit attention. They tend to perpetuate a number of misconceptions about fluoridation which I believe it is important to correct.

The scientific basis of fluoridation has been discussed competently and extensively (*5, 6*). It is, of course, impossible to cover briefly all the arguments proposed in the past by antifluoridationists, but I should like to review certain fundamentals that are pertinent to the correspondence.

The fluoridation program is founded on the observation that people who have lived continually from birth in areas where the domestic water contains fluoride ion in a concentration of approximately 1 part per million develop substantially fewer carious lesions than comparable populations whose water contains only trace amounts of fluoride. This observation has been confirmed repeatedly by independent investigators in many parts of the world, in communities where the fluoride is present either naturally or as a controlled supplement to a fluoride-deficient water supply.

The mechanism of the fluoride effect is still under study, but available evidence supports the hypothesis that, in populations exposed to fluoridated water, such water exerts a beneficial influence upon the teeth themselves during the period of their development and calcification (*6*). The effect is produced during childhood, but it persists throughout life, even though the individual may in later years live in an area where the fluoride content of the water is suboptimal.

Several correspondents revive the suggestion that fluoride could be provided in tablet form or in salt, milk, bottled drinking water, and other vehicles. The suggestion appears reasonable until one recalls that the efficacy of such alternatives to fluoridation has not adequately been demonstrated and that there are cogent reasons to suggest that they should not be expected to yield comparably good results.

A bottle of fluoridated water in the refrigerator will provide only a fraction of the water normally consumed in the diet. Important sources, such as the water used in cooking, canning, and the manufacture of bottled beverages, would be by-passed. The child would not receive fluoride in the water that he consumes at school or elsewhere when he is away from home.

Fluoride provided solely in milk or table salt would not reach infants in appropriate amounts, because these products are not usually fed to babies until they are several months old. Moreover, the distribution of fluoride-fortified milk or salt would have to be controlled carefully to insure that the products would not be available in communities or rural homes where the water already contained enough fluoride; the possibility of inducing mild dental fluorosis must be considered, even though that condition is undesirable only from the standpoint of appearance, not of health. A child who continually received adequate fluoride from water and food and additional amounts from milk and salt might develop signs of dental fluorosis. Manufacturers are not presently prepared to cope with these problems on a wide scale.

The diligent use of tablets or extemporaneously prepared water under careful supervision has been recognized conditionally by the Council on Dental Therapeutics of the American Dental Association to be a safe procedure when community fluoridation programs are not operating (*7*). But the council emphasizes that evidence for the efficacy of these procedures, even when they are carried out conscientiously by

responsible parents, is meager. Sufficiently large groups of individuals have not yet been studied, and the investigations that have been reported were not satisfactorily controlled. Many did not cover a suitably long period of time. The studies demonstrated clearly, however, that the administration of fluoride by these means produced no harmful effects. Economically, water fluoridation remains the least expensive method for providing fluoride supplements appropriately. This fact stands, despite the juggling of figures and the many misinterpretations which have been employed to challenge it.

The concept advanced by Court (*2*) that fluoridation should not be accepted "until . . . [it] is demonstrated to be the only feasible method of reducing dental caries" is patently absurd. No hungry man would rationally refuse to accept a wholesome meal until he had been shown that there was no other source of nourishment.

Those who continue to charge that the use of fluoridated water is harmful have yet to produce supporting evidence that will withstand scientific scrutiny. Proponents of fluoridation as a health measure have studied the aspect of safety with extreme care and have found no evidence of harm. One pioneer of fluoridation programs said many years ago that the opponents tell us, in effect, "We know you haven't found any evidence of harm but we know it's there; keep looking." Vigilance has not slackened, but all responsible health organizations are convinced that the use of water fluoridated at the recommended level is safe for all populations and all age groups.

Arguments concerned with mass medication, deprivation of individual liberty, invasion of privacy, infringement of religious freedom, and the like have been weighed repeatedly in the courts and invariably have been rejected.

Rodale's remarks (*3*) should be considered against the background of the many quaint but hardly scientific notions about "natural" foods, "organic gardening," and the like which are promoted through the articles and the abundant pages of advertising in his magazine, *Prevention*. The "reputable and capable scientists," and the "evidence indicating that fluoridation is a potentially harmful practice" which he says these scientists have produced, evidently failed to impress evaluating agencies of the American Dental Association, American Medical Association,

National Research Council, American Public Health Association, and many other groups acknowledged to be reputable, including the Council of the American Association for the Advancement of Science.

The opposition to fluoridation has awakened the interest of behavioral scientists, who see in it an excellent opportunity for field study (*8*). It is to be hoped that psychologists and sociologists will succeed in explaining why fluoridation is resisted so frequently in spite of the overwhelming evidence of its safety and benefits. Perhaps, too, the more vociferous opponents of fluoridation will search their souls more closely and consider whether they are morally justified in satisfying their emotional needs by striving to deny relief from dental pain and disease to millions.

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With the publication of Pearlman's letter, Science *concludes the current series of letters on the fluoridation issue. For the time being, no further comments on this subject will be accepted.* —ED.