Contamination in Countryside and Home

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'Conservation, environment, pollution—the words toll like bells through public discourse these days.' This was the opening sentence from a leading article in the London *Times* last November. The pity is that, on this subject, passions are easily aroused, and people generally are influenced far more by resounding chimes than by detached logic. Toxins take on the reverberations of death knells. Consequently, every opportunity should be taken to supplant prejudice by informed reason.

Today, terms like 'contamination' and 'pollution' are bandied about with an indiscrimination that might be regarded as reckless, if it were not so tendentious. Sadly, the principal perpetrators in this respect are so often those latter-day Rousseaus who champion the 'back-to-nature' movement. From its etymological origins, 'contamination' simply means a 'bringing-together', irrespective of the consequences. 'Pollution', on the other hand, has a much more ominous connotation, implying a loss of purity, a departure from sanctity. There is more than an undertone of evil about it. This can be clarified by an example. In a particular foodstuff a synthetic chemical may be discovered in minute concentration. There is contamination. But is this of any consequence to the consumer, as distinct from the opportunity it affords the chemist for displaying his analytical skills? Judgement must be based on the compatibility with health when such a foodstuff is subsequently eaten. If the outcome should be an adverse reaction, 'pollution' has occurred. It is my contention that whereas a non-biological scientist can perfectly well pronounce on 'contamination', only someone adequately versed in the assessment of health can decide on 'pollution'. Today, unfortunately, we are beset by far too many self-styled arbiters of our welfare who overcome irrelevance and inadequacy of data and leap the chasm of extrapolation with an adroitness that almost commands admiration. Their creed, as expressed by a well-known exponent, reads, 'The whooping crane's environment is ours too'. I, for one, hope that this sort of analogy will not be carried too far. Personally I have a selfish wish to survive, even if that indecent urge should thereby demand the complete demise of the rattlesnake and thorough-going elimination of the yellow-fever vector. Wayland Hayes, after all, has reminded us that in this

witch-hunt for dangerous chemicals we are all too likely from our animal experiments to arrive at a 'world fit only for rats to live in'.

ORGANOCHLORINE INSECTICIDES

In turning now from the general to the particular I have chosen first the organochlorine insecticides—such chemicals as DDT, aldrin, dieldrin, and endrin. These are the insecticides upon which the vociferous and car-sticker-crazy members of our community demand that a total ban should be forthwith imposed. In so doing it is possible that these agitators may overlook the credits on the other side. Malaria, for example, has by such attack been controlled to an unprecedented extent. On a more homely scale those clouds of flies that used to plague our houses and our foodstuffs throughout the summer months despite the glutinous (and, incidentally, sometimes homicidally hazardous) fly-papers ineffectually suspended to trap them, are virtually seen no more. Surely this is to our good, if only because these airborne hordes had a propensity for alighting regardlessly on the dunghill and the kitchen table, in turn. The wasps, too, have largely disappeared, as well as most of those delightful little predatory creatures that used to besport themselves as various body infestations.

The cost of all these benefits, it is averred, has been too great. Without doubt, in single, acute overdose, the organochlorines can be manifestly toxic, causing stimulation of the central nervous system and epileptiform seizures. This has occasionally been seen in manufacturing plants where safety precautions have been disregarded (Jager, 1970). We had an instance, too, in which a child picked up a disused container in a field and drank the contents—in fact, aldrin. The youngster had repeated fits over some hours, but eventually recovered. I am unacquainted with any fatalities in this country, though deaths have occurred in different parts of the world. What is so distinctive, however, about this group of chemicals is their inordinate stability, both chemically and biologically. This is an advantage to an insecticide, as one application confers a long-lasting effect. Yet this very persistence also leads to transfer throughout the food chain, from flora to fauna and from one creature to another, with a tendency to ultimate accumulation in carnivorous species. Traces have been detected in ocean plankton and penguins. It is this ubiquity throughout the environment that has contributed largely to the alarm. In some cases birds have succumbed; in others the reproductive capacity of certain species of wild life has been impaired. Unfortunately, from sparsity of established examples of cause-and-effect, mere presence elsewhere has become identified with deleterious consequences. Contamination and pollution have thus been confused. While the low levels of residues detected

may be testimony to analytical sensitivity they do not necessarily provide in themselves a corresponding toxicological indictment (Goulding, 1967; Hunter, 1967).

From surveys carried out in this and other countries there is good reason to believe that everyone is harbouring in his (or her) body fat a small but finite store of insecticidal organochlorine residues (Egan *et al.*, 1965; Hayes, 1966). At once we face the crucial question—are they causing, or going to cause, any harm to their hosts? At this stage I admit we cannot deny this with any certitude. What we can say is that animals with a much higher exposure throughout the life span have suffered no detectable adversity, while factory workers handling these materials over many years and known to be carrying a much greater load in their body fat have, on the most searching examination, physical, biochemical and psychological, failed to show any disorders on this account (Jager, 1970).

From studies in different communities a mathematical relationship has been established between total uptake and concentration of organochlorines in the body fat. Applying this formula to the ascertained body fat levels among the United Kingdom population, the total uptake has been calculated. Independently, organochlorine analyses have been carried out on typical British diets. From these two sets of figures it has been shown that all but a very small percentage of our organochlorine uptake must have been derived from our food.

Some three years ago, with a group of experts, I had the opportunity to examine what are called the 'non-agricultural' uses of the organochlorine insecticides—in hygiene and public health, in the preservation of timber, in the protection of wool, in the home, and so on. We could not avoid the conclusion, so far as man was concerned, that his body uptake from these sources was almost negligible.

MERCURY

By contrast to the synthetic insecticides, mercury is a natural element in the environment—in soil, rainwater and sea, in flora and fauna, and in the human body, albeit in minute quantities. Unfortunately, what might be termed a 'normal' and, at the same time, a safe background level has not so far been determined. For centuries mercury and mercurials have been employed medicinally. More recently the exploitation of organic mercurials as commercial fungicides has expanded enormously, and on the farm they remain unsurpassed. In the home an extraordinarily large number of products contains mercury in one form or another—paints, polishes, toothpaste, copy paper, contraceptives, disinfectants, and so on. Industry, too, discharges its

quota of mercurial effluents. Man's exposure to this element must today be quite considerable. Whether it has reached a truly hazardous degree is still undecided. Occupational hydrargyrism is still seen occasionally, in spite of industrial hygiene, although the incidence now is low compared with that of the past. In Japan a few years ago the geographically named Minamata disease provided an arresting outbreak of organic mercurial poisoning in an island community (Kurland *et al.*, 1960). Various figures have been proposed as maximum acceptable daily intakes for man, but none of them has been universally adopted. Some guide to individual status can be gained from the 24-hour urinary excretion of this element, a figure above 100 μg serving as a warning (Bidstrup, 1964). This, however, is by no means constantly related to the appearance of physical or any other changes. Epidemiologically, various claims have been made of an association between mercury exposure and, say, renal disease, but these remain unconfirmed and unconvincing. In Sweden, scientists have paid special attention to mercury in the home, on the farm, and elsewhere and have warned of the likely risks from the high environmental levels. As a result, statutory limitations have been introduced. The World Health Organisation has, moreover, urged that 'Every effort should be made to control and reduce this form of contamination of the environment and consequently of food'. This surely is an appeal that we should seek to implement, especially since the recent alarm about organic mercury in tuna fish, about which a very reasonable official course seems to have been taken in this country.

ARSENIC

Arsenic, again, is an element that is undeniably toxic but it is widely dispersed in nature (Buchanan, 1962). In the home nowadays, it seldom obtrudes, although the arsenical 'tonic' may still rear its sinister head. On the farm, the arsenical pesticides are far less popular than hitherto. Whether, biochemically, arsenic performs some essential metabolic function in the body, possibly by its affinity for sulphydril groups, has not so far been ascertained. At all events, the element has consistently been detected in the tissues and urine of otherwise healthy subjects, albeit in minute amounts. At higher levels toxic reactions are well recognised. As far as food is concerned, maximum tolerances have been set by law, both in the United Kingdom and elsewhere. This makes it imperative that the utilisation of arsenicals on the farm should not give rise to excessive residues in vegetable or animal products. Certain organic arsenicals, e.g. 4-hydroxy-3-nitrophenylarsonic acid are widely used as 'growth promoters' in the rations of farm livestock. Related compounds also feature in veterinary medicine. The possibility of an environmental accumula-

tion thus emerges. Extensive studies conducted at different centres in the United Kingdom by way of monitoring have so far proved most reassuring.

CONCLUSION

In this short article it would have been unrealistic to attempt anything like a complete survey of contamination in the countryside or in the home. Instead I have chosen three examples for the sake of illustration. The multiplicity of other chemicals that today find their way into agricultural or domestic use are indeed subject to restraints. Their development, commercial release, and usage in this country are under a comprehensive, official scheme of control, voluntary and non-statutory though it may be (Goulding, 1969). Perhaps that is why those of us who are medically involved in this scrutiny are very sensitive to alarmist assertions, especially when they arise from wild-life advocates whose strong feelings tend to override their critical judgement, and more so when the most castigating allegations are made by writers in popular scientific journals or national newspapers whose journalistic flair, one suspects, is inversely proportional to their scientific authority.

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References

Bidstrup, P. L. (1964) *Toxicity of Mercury and its Compounds*. Amsterdam: Elsevier.
Buchanan, W. D. (1962) *Toxicity of Arsenic Compounds*. Amsterdam: Elsevier.
Egan, H., Goulding, R., Roburn, J. and Tatton, J. O'G. (1965) *Brit. med. J.* **2**, 66.
Goulding, R. (1967) *Proc. roy. Soc. Med.*, **60**, 26.
Goulding, R. (1969) *Wld. Rev. Pest Control*, **8**, 170.
Hayes, W. J., Jr. (1966) *Scientific Aspects of Pest Control*, Publ. No. 1402, p. 314.
Hunter, C. G. (1967) *Proc. roy. Soc. Med.*, **60**, 27.
Jager, K. W. (1970) *Aldrin, Dieldrin, Endrin and Telodrin*. Amsterdam: Elsevier.
Kurland, L. T., Faro, S. N. and Siedler, H. (1960) *Wld. Neurol.*, **1**, 370.