

February 29, 1972

Mrs. Norma I. Halley
336 Vermont Street
West Roxbury, Massachusetts 02132

Dear Mrs. Halley:

I am impelled to answer your letter of February 6th, because of your obviously genuine interest in the problem of the behavior of lead in the human body. Let me say at once that J.J. Chisolm, M.D. of Baltimore is extremely well informed on most of the physiological aspects of the matter, and, in addition, is one of the most experienced physicians in the country or elsewhere in the world, in dealing with the problem of lead poisoning in children. I know him well professionally; we have corresponded with each other, and have talked together on several occasions.

The physiological (or biochemical) behavior of lead in the body, however, is, or seems to be, a fairly complicated matter, and certain aspects of its behavior cannot be visualized in detail at present. On the other hand, the matters about which you write are reasonably well understood in the gross sense, rather than in their detailed mechanisms. I shall attempt to answer your questions, therefore, and do so in terms of experimental observations on human beings, which we have carried out in the Kettering Laboratory over a period of about forty years.

First, the absorption of swallowed lead (only that in food and beverages, under ordinary circumstances) varies with a number of factors, but over a considerable period of time in the experience of a large number of persons of various ages, the average level of absorption ranges from 5 per cent. or less to about 10 per cent., dependent mainly upon the quantity swallowed. The lead content of the food and beverages taken in per day, by individuals, varies according to the amount of food and beverages consumed, and the type of food chosen - whether relatively high or low in lead. The values under ordinary circumstances range from slightly less than 0.10 milligram of lead per day to over 2 milligrams of lead per day (when certain contaminated items, such as sprayed fruit or salad materials have been eaten). The high values are infrequent because of the usual precautions taken in growing and marketing fruits and vegetable products, and in preparing such items for the table. Beverages, also, in the U.S.A. are usually very low in their lead content, but occasionally contaminated items are eaten, and also illicitly distilled liquors are often - very often - badly contaminated. A large number of small sources or opportunities for contamination exist and are being revealed periodically. This is one area in which the U.S. Food and Drug Administration (as well as private groups) has been actively engaged. At present, the average daily intake of lead, by the adult male, in food and beverages amounts to about 0.25 to 0.35 milligram. (This matter has not been investigated in the human female to such an extent as to yield representative information.) Persons whose daily intake of lead is of this average order of magnitude absorb only about 5 per cent. of that consumed, while the remainder simply is carried through the alimentary tract and is evacuated unabsorbed in the feces. If the amount consumed in food and beverages is

N 5988

of this order of magnitude, and, if, in addition, the lead content of the air breathed is of the order of 1 to 2 or 3 micrograms per cubic meter, there is no evidence of the accumulation of lead in the body - that is, the average amount taken in per day is equivalent to approximately the amount evacuated in the feces plus that actually excreted in the urine and feces. Balance experiments which they have conducted on a number of individuals reveal this relationship.

On the other hand, some experimental observations on deceased persons indicate that the lead content of the skeletons of males in certain western populations, particularly, tend to increase with age, up to about forty years of life. This is not universally true, and the difficulties here in formulating a thoroughly documented conclusion are very great, because of the variability of human experience in relation to opportunities for intermittent exposure to lead. How can one appraise the entire experiences of an individual's life, after he is dead, with reference to his opportunities for exposure to lead? The answer to this is, sadly enough, that only in rare instances, and especially in the case of women, can one find out whether the individual has had no unusual exposure to lead during his (or her) lifetime. Dr. Chisolm is merely stating, in this instance, the most common view of this matter, which is still to be proved true or false. I've been studying this matter in detail for many years, and I must confess that I do not know precisely where the truth lies. I have certain opinions, but until and unless they can be proved to be true or false, I am in no position to state the facts. Dr. Chisolm is at liberty to speak of the current opinion of most people as the truth. As an investigator of this matter, for the past forty years, I cannot do this, for I know all too well the basis for and against certain current opinions (not necessarily facts).

I believe, from what I have said above, that you will understand that the questions which you raise cannot be answered flatly or simply, without going into the large mass of detailed information which has been made available in modern times by means of modern methods of investigation which were not available twenty five or thirty (or even ten) years ago.

You speak of the item of 44 milligrams of lead per day as found in the feces of a child, as proof of an high rate of "excretion." Indeed, this is not at all true. The finding of 44 milligrams in the feces on any one day can only be interpreted to mean that a large amount of lead was swallowed during the preceding day or two, most of which traversed the alimentary tract unabsorbed. What is shown here is the severity of the exposure to lead (usually removed from the painted surfaces in the vicinity of the child). Fecal "excretion" does not mean evacuation in the feces, but actual secretion (or excretion) of absorbed lead from the cellular lining and the glandular tissues which empty into the alimentary tract. This occurs, and can be determined, by appropriate means, but it must be remembered that most of the lead passing through the gut has never been absorbed but is merely within the "sewer system" of the body.

I cannot rewrite the details of the physiologic behavior of lead in man, so far as it is known and documented, but I shall send this, handwritten, to my secretary in Cincinnati, to pass on to you as typescript, together with a copy of the Harben Lectures, published in 1960-61, in which, in 1960, I outlined the facts as revealed up to that time in our "balance" experiments under conditions of ordinary and also excessive exposure to lead. As a graduate student, you are entitled to, and should

have, this information, which is not readily available in any one publication made in the United States. I am attempting to prepare for publication, in a monograph, the details of these and other experimental and clinical observations on lead. It will require a large amount of work, and considerable time on my part to do this, but I hope to be able to complete it before long - at least before the disabilities of old age, with their final denouement, shall have overtaken me.

Cordially yours,

Robert A. Kehoe, M.D.
Professor Emeritus of
Occupational Medicine

RAK:wb

Dictated but not read