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Review of the Schroeder and Tipton Paper
on the Human Body Burden of Lead

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Enclosed you will find a summary of my thoughts on the Schroeder and Tipton paper. I tried to be concrete and succinct, but if there are questions regarding my comments, I will try to answer them.



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GR/n

Enclosure (1)

cc: Dr. A. S. Hawkes (Encl. 1)

Dr. George F. Kirby (Encl. 1)

Dr. Robert A. Kehoe (Encl. 2)

STATEMENT REGARDING THE SCHROEDER AND TIPTON PAPER

"THE HUMAN BODY BURDEN OF LEAD"

This paper sets out to evaluate the magnitude of the body burden of lead in men around the world, the balance or steady state of lead in the body, the accumulation of lead with age, the effect of body burden of lead on health, and finally on evidences of subclinical toxicity from lead.

These authors use their data to calculate the body burden of the "standard man" and the results are consistent with what has been reported in the past (the Harben Lectures of Kehoe), and so their findings are not unexpected.

In their comparison of the body burden in U. S. subjects with those of other countries, they state that the body burden in the United States is significantly higher than in Switzerland, Africa, the Middle East, and the Far East. It is difficult to relate their findings to the blood lead concentrations around the world as reported by Goldwater and Hoover which show that the U. S. levels were lower than those of Finland, United Kingdom, New Guinea, Yugoslavia, Japan, Czechoslovakia, and Chile, the same as in Egypt, but higher than in Argentina, Holland, Poland, Sweden, and Peru. In other words, the Goldwater data says that the United States is about in the middle of this world-wide survey. Though there is probably not a perfect correlation between the blood and the total body burden, the blood concentration certainly does reflect the body burden and there is a positive correlation between the two.

Further regarding the Goldwater data, the blood concentrations would suggest that the Far East was high, that is, Japan and New Guinea were relatively high; this data would be consistent with the findings of Schroeder and Tipton. Nevertheless, when we consider that the concentration of lead in the blood in Czechoslovakia was 19, in Finland 25, in Sweden 10, and in Yugoslavia 20, it is apparent that caution is required in the interpretation of data from an apparently similar geographic areas as well as with quite similar cultures. An explanation for these relatively large differences is not available but undoubtedly is not due to lead in air.

Whether lead accumulates with age has been a subject of interest for many years. A review of the graphs of Schroeder and Tipton could easily lead to the

conclusion that lead does not accumulate after 30 to 40 years of age or possibly even after 20 to 30 years of age, in the liver, spleen, kidney, heart, lung, and even in bone.

When we consider that 90% of lead is found in the bone, this is the organ that must be given the greatest attention when attempting to determine the accumulation with age, and the bone concentration did plateau.

The enormous variation found by the authors in the lead content of tissue makes it difficult to draw conclusions regarding accumulation and there ~~is~~ ^{are} not much ^{few} data available to discuss the pros and cons of this problem; this data, therefore, ~~does~~ have usefulness in that ^{it is} the first real ^{indication of} such accumulation. I can refer again to a study on blood concentrations and to an article from the WHO Chronicle, published in 1967 by Goldwater, which stated the following, "These studies confirmed ~~in~~ previous reports on the ubiquity of lead." When the results were compared with those of similar studies in individual countries made during the past three decades, there is a remarkable agreement in the range and means of concentration of lead in both urine and blood (without significant changes over this time).

The authors make much of the absorption of lead from the lungs. Kehoe in his chamber study has found that something less than 50% of lead inhaled is retained in the body. Part of the lead that is retained is deposited in the upper respiratory passages and part in the deep lung. If we use the Schroeder figure, then 1×20 cubic meters = 20 micrograms inspired, and so 10 micrograms is retained in the body. The fate of this 10 micrograms is not understood at the present time; part of it is undoubtedly absorbed from the lung and part of it also ends up in the gastrointestinal tract. It has been estimated of that deposited in the deep lung, one-half is eliminated and swallowed in the first twenty-four hours; approximately 5 micrograms may be absorbed from the lung but the present state of knowledge and technique is such that we cannot determine the fate of this small quantity (the remaining 5 micrograms may have a half life of 120 days in the lungs). My point is that I can't handle this problem any better than does Schroeder; I do not know what portion of the inhaled lead does reach the deep lung or its fate, once deposited there. The 6 micrograms as listed by Schroeder is probably on the high side.

I think it significant that Schroeder found no evidence of chronic disease in persons of high body burden of lead, and also that he found that the lead burden had no effect on the concentrations of essential trace metals in the body. Equally important, Schroeder now states that lead does not cause a shortening of life span ^{and} as he had stated in a previous series of articles in the Journal of Nutrition.

And finally, he states that lead in air has increased but if we are to take the Tri-City Study as well as a paper by Cholak in 1961 and again in 1968 we find reports that state otherwise; it is not going up.

In summary, Schroeder's general conclusion concerning the body burden is about as has been presented in the past. He did demonstrate a difference in the body burden as compared to that in other countries, and his findings are difficult to refute although these conclusions are inconsistent with the blood levels reported for these countries. Whether there is an accumulation with age is not established at all, in my opinion. Since the total body burden isn't changed by Schroeder, the question is only whether the man gets his body burden over a period of 30 years as suggested by Kehoe or over a lifetime. Schroeder suggest that this is progressive over a lifetime but I choose to say that the accumulation is completed by the age of 40.

On the plus side, Schroeder says lead does not produce a shortening of ^{7u}life span ⁷¹⁰⁵ and also he states that chronic disease was not associated with an increase in body burden of lead.