

June 15, 1937

Dr. Kenneth D. Blackfan
Harvard Medical School
Children's Hospital
300 Longwood Avenue
Boston, Mass.

Dear Doctor Blackfan:

I have at present a considerable mass of data which have been accumulating over a period of a year or more, and which I am now ready to work up. When I have completed the study of these data, I shall be able to answer the question in your letter of June 7th more accurately than I can do offhand.

As to the lead concentrations in the blood of normal persons, and in persons exposed to lead, I am sure I shall be able to give you very satisfactory figures. I am not quite so certain in the case of the spinal fluid for we have not studied enough either normals or exposed to be quite sure of the range of variability.

The blood levels of normal persons range from .01 to .05 milligrams per 100 grams of blood. The mean is somewhere between .02 and .035. (Some time ago we published figures slightly higher than these, but since we have been studying samples obtained only by ourselves and analyzed in a laboratory which is free of outside atmospheric air, we have found the figures to be slightly lower.) We have a large enough series of results here that any slight errors in analysis cancel each other, so that there can be no question as to the accuracy of these results. During the past 6 months, we have been doing analyses on blood by two methods operating in parallel, the one our Spectrographic Method as described by Cholak, and the other a modification of the Dithizone Method as originally described by Fischer and Leopoldi.

We have seen lead in the blood in various types of plumbism in concentrations extending from slightly in excess of a milligram per 100 grams of blood down to one tenth of a milligram per 100 grams of blood. In general, two factors appear to determine the height of the lead concentration; one, the severity of exposure; and two, the time interval between the cessation of exposure and the taking of the blood sample. Generally,

04437

the severity of the symptoms correlate with the height of the lead concentration, but this is not always true. I think it is quite safe to say that the presence of one tenth of a milligram of lead per 100 grams of blood is indicative of a recent significant exposure to lead, and although symptoms may not be present at this concentration, the existence of symptoms resembling those of plumbism may be adequately explained. I should be inclined, at present, to regard values under one tenth of a milligram of blood as significant only if repeated observations confirm this as the basic level of lead concentration rather than a chance high value.

The lead values in the spinal fluid are much lower. From our present data, which are incomplete, I am disposed to regard values in excess of .01 milligrams per 100 cc of spinal fluid as doubtfully significant; values in excess of .02 milligrams per 100 cc of spinal fluid as almost certainly significant; and values above .03 as definitely indicative of recent significant lead exposure. I believe when we have sifted the thing as carefully in the case of spinal fluid as we have in the case of blood, we shall probably find the normal values to range between .001 and .01 milligrams per 100 cc. In acute lead cases, we have found values as high as .1 milligrams per 100 cc. I believe, without referring at this time to my records, that this occurred in only one case in which the diagnosis was at no time a matter of conjecture. This will require confirmation through observations on similar cases, since you will realize, I am sure, that there are numerous opportunities for slight contamination, particularly at the bedside. As a matter of fact, we make it a point at present not to make analyses of spinal fluid, or of blood either, unless the samples are collected by means of our own needles, into our own containers, and by a technique which we describe in detail. The use of the ordinary hospital spinal fluid needle is almost certain to result in contamination since the construction of the needle is such that the fluid may come in contact with lead-bearing material.

I trust this will give you the information you require, and I shall be pleased to give you any additional information as a refinement of this when I have completed the study of our data.

Cordially yours,

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Robert A. Kehoe, M.D.

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