Graduated as M.D. in 1884

Thesis

Subject:

Chronic Lead Poisoning.

I hereby certify that this Thesis is entirely composed by me.

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Candidate for the Degree of Doctor of Medicine.
Chronic Lead Poisoning.

Introductory Remarks.

The reason I have selected the subject of Chronic Lead Poisoning to lay before you as a Thesis, is because, during the last four years of my Practice here in Wolverton, many cases of more or less severity have come under my notice, and I have therefore had ample opportunity of observing the various features presented by them, and forming my own theories and conclusions concerning the phenomena presented in this form of Chronic Poisoning.

The London and North Western Railway Company employ here about 2,700 men in the building and construction of their Carriages, and a large proportion of these men are engaged in (amongst other departments) the Trades of "Painters" and "Body Makers." These "Body Makers" in other words are Carpenters & Joiners, they make the Bodies of the Carriages. It is in the men of these two departments that Chronic Lead Poisoning may be so frequently seen and observed. By far the larger proportion of the cases, I have found to exist amongst the "Body Makers," extremely few being found amongst the "Painters." The reason of this is obvious. Every piece of wood used in the construction of a Carriage for this Company, must be varnished by the "Body Maker" with a liquid solution of Pure White Lead. This is done with a brush in the most careless manner, and is for the purpose of preserving the wood. In the case of the "Painters" their paints are ready mixed for them, and do not contain lead.
quantities of whole lead, and consequently not coming into so direct a contact with it, they do not suffer so much as the Body-makers.

It is further within my experience that when "Body-makers" suffer from chronic lead poisoning they present all the various varieties of symptoms, whereas the Painter usually presents a decidedly Rheumatic or Gouty type, a result due, I believe, to the smaller amount of lead to which they are subject, and to the longer time they require to be exposed to it before any decided symptoms show themselves. I shall proceed to describe chronic lead poisoning as shortly and systematically as possible, chiefly from cases I have taken of cases which have been under my care, giving as far as possible my own theories and observations of the disease and commenting on those of others.

The Books of Reference to which I am indebted for some points and to which I must refer you are the following:

Ziemssen's Cyclopaedia of the Practice of Medicine Vol. XVII.
C. Hilton Fegg's Dr. Gross in the 59th Vol. of the Medical Clinic, London.
The British Medical Journal in March 1861.
Gautier in an article in the British Medical Journal in December 1861.
Forester in a paper read at the meeting of the German Society and published in the British Medical Journal in May 1862.
The Heilmyer Case recorded in the British Medical Journal for Dec. 25/62 and Nov. 4/62.
Bombard in the London Medical Record for July 15/70.
Junker... Aug. 15/70.
Aetiology.

Lead is introduced into the system in many different ways. Certain trades in which lead is one form or another is used, furnish by far the largest number and variety of cases. Amongst these may be mentioned especially:

Workers in White Lead Factories. These suffered immensely before the present stringent measures were ushered in. The Carbonate & Oxide of Lead are the preparations towards which they are subjected.

Painters, from using white & red lead.

Body-makers, from using white lead to paint the wood with.

Weavers, from using lead weights in the looms, and from using chrome of lead in the spinning of certain orange colored cloth. The yellow dust then is inhaled. D. Smith records seven cases of weavers suffering from the effects of chromate of lead in the British Medical Journal for Jan. 7/42.

Plumbers & Gas Fitters, from using lead & lead cements.

File-makers, from using lead cushions in cutting the file, the lead dust is which the file is hardened & the lead could react in the lungs during finish. D. Porter read a paper, records in the British Medical Journal for March 3/42. Directing attention to the frequency of Lead Poisoning amongst the file-makers in Sheffield & Tinsley, some few years ago. In the paper referred to was read,说道 severe cases of Chronic Lead Poisoning as the Sheffield Dispensary & File cutters & also at Rotherham amongst the file cutters. There he called attention to the fact.

Type Founders, from using lead in the manufacture of the Type.

Printers, from using the Type.

Prospect makers from the same cause.

Potters, from glazing common earthenware, the glaze containing large quantities of the lead compounds.

Amongst other trades of less importance may be mentioned: Glass makers, Brush makers, Glass enamel makers, Illuminators in
with others, Dyers, Sugar refiners, Shoe makers from the lead ovens. Come polishers from lead cylinders and, Composition die makers, Dyers and paste makers, & many other trades.

One of the most important means of introducing lead into the system, is through the Drinking Water.

The purer waters and those containing more oxygen can guard to take up more lead. Waters containing much organic matter such as nitrates, nitrites, or chlorides can upon lead, especially those containing ammonia or nitrate from decomposing organic matter. In the well known Newbury case the manchini was told to the Town water which has a peculiar propensity for taking up lead.

The smallest quantity of lead in water, even though sulphured hydroxide fails to detect it, may produce lead poisoning. Thus from ⅖ to ⅙ of a grain of lead to the gallon has been known to produce poisonous effects.

Water when allowed to stand in certain vessels containing lead in their composition will absorb it. Thus lead pipes & cisterns are extremely dangerous. Of such utensils further may be mentioned Kettles, Bodens, & Frying Pans from their soldering containing lead. Glazed Earthenware Pans, especially if badly glazed, these are burnished with a base silicate of lead, or the glaze may contain latharge, which imparts lead oxide and this is especially notable if the water contains any acid.

Some Town waters have been found to contain free acids as sulphuric or hydrochloric acids. And when this is the case they most readily take up lead. Thus in the Huddersfield water, Allen found it was free hydrochloric acid, no sulphuric acid as was supposed, because the Chlorides were more than sufficient to combine with the Sulphuric acid if there were any present. Sulphate in water does favour its carbonic properties.

Cases of lead poisoning have been found in board ships due to the mineral
used in the apparatus for distilling sea water for drinking purposes.

Certain articles of food have produced poisoning through their having been
in vessels containing lead. Fatty matters and acid fluids are especially
prone to take up lead. Fish and vegetables, fish, shell fish, and meat are frequent causes, the hogs here are addled with lead
alloy. These articles most rich in fatty matters, especially
fish fried in oil, are found to contain most lead. Fruits eaten
contain very minute quantities. White meats vary a great deal.
Milk will under certain conditions take up lead. Thus it was found
that 100 grammes of milk was left to ferment in a glass receptacle
and 32 centi-grammes of sulphate of lead was removed from it.
When the glaze becomes ragged the interstices are filled with
metallic & fermenting substances & thus the danger is increased.
Flour bread are sometimes adulterated with lead. Confectionery
has been colored with chromate of lead. Several cases of poisoning
are recorded, as occurring in America, from meat which had been
manufactured at a mill where the flour stones were old & the
interstices of which had been filled up with lead.

Certain Corked Vessels contain lead in very poisonous quantities.
The so-called elder waters often contain very variable quantities
which in Cuba the vessels have been kept lying down.
Quinoa beer has been found to contain it. Geotypos & India ruben
wines used for these beverages are frequent sources.

White wine & vinegar are very good from 10 to absorb it from the
bottles in which they are kept. Glass contains from
20 to 100 per cent of its weight of oxide of lead. Silt is often
left in wine bottles so as to be a source of adhesion, or the wine
may be sweetened with the compound of lead.

Cider and the Late in Brews tanks, and Beer Drawn through
leaded pipes contain it.

Articles of Luxury may also be caused. Thus various cases are
read from smoking. The snuff is sometimes wrapped in paper containing tinfoil, or sometimes, snuff is counteracted with red lead. This tinfoil or tinfoil is sometimes used to cover articles of clay, and when exposed to dampness it decomposes and carbon monoxide of lead is formed.

Hair dyes from containing small amounts of lead have been found to cause various symptoms. Hair waxes and creams also frequently contain lead.

Certain articles of clothing are said to be more or less injurious from containing lead. Thus silk thread and Brussels lace. Children have been known to exhibit symptoms from the lead contained in the American cloth of their perambulators.

Hair mastic, from the hair having been dipped black with lead, colored paper, and even shoes have been impregnated with lead, and are said to be dangerous.

Cases of poisoning occur in which it is extremely difficult to ascertain the source of the lead.

In all its forms lead is poisonous and parasitic.

Symptoms have been produced medically by the internal use of layers of lead, or by lead paste, plasters, injections, eye washes, and lotions. There is a curious case recorded of poisoning through a lead bullet being allowed to remain in the body.

The quantity of lead taken at a single dose is not as important as its continued introduction. If a large quantity be taken but little is absorbed for we never find large quantities in the internal organs. Attacks of poisoning may occur long after exposure to lead has ceased. As all the preparatory lead can pass out whilst it seems to me impossible for poisoning to take place from drinking in nearly painted rooms or from walls papered as some would maintain and, I am inclined to conclude that lead must be taken in by the mouth or air passages, either in the
solid state, or dissolved in food or drink, or applied to the skin
broken or unbroken for a long and continued time to produce
its effect. Some hold, and I think correctly, that it cannot
be absorbed by the unbroken skin, so great an authority as
Templeton holds this view.

Among its predisposing causes may be mentioned especially
persons addicted to alcoholic drinks; these are especially liable.
Children are more prone than adults, sex makes little or no
difference. This is my experience, no doubt, meets a very powerful
influence. In my experience persons of a gouty or Rheumatic
diathesis are very liable to feel early the effects of lead, and
I believe this is the experience of most other observers, is certainly
so the case here.
Anatomical Characters and Pathology.

It is no doubt owing to the few deaths that have taken place from chronic lead poisoning, and to the extreme difficulty in making a complete and complete examination of the Spinal Cord and other portions of the Central nervous system, that the anatomical characters and pathology of this disease are so little known. In these few cases where Post Mortem examinations of undoubted and uncomplicated cases have been made, observers have, with some exceptions, viz a case recorded by Zuntz, and one mentioned hereafter, failed to detect any important pathological changes distinctively of the brain. This is clear, in my opinion, to the word of the myelin sheaths in proper care in the minute examination of the central organs of the nervous system. It will be my duty here to state and comment upon the various theories which have been justly urged with my own especial theories, to account for the various brain of symptoms observed in Chronic Lead poisoning. Lead, not being a nuisance constituent of the body, it then forebodes, when found in it, it must be abnormal. No one now holds with Gouton that it always exists in the blood as a Carbonate normally. In these cases, when death has undoubted occurred from lead poisoning, it has been found in almost all the viscera. Thus, Gouton found it always in the muscles and joints; sometimes in the brain and ears, often in the liver and kidney. In some experiments on animals to which Gouton had given lead, he found it deposited in muscles and absent in bones only if it was the Central organs of the nervous system. He found it also largely in the bones, and this is interesting, for many minerals lime is in many instances replaced by lead, and it is probable therefore, that lead behaves in the Brain much in the same way that lime does amongst minerals. In the supposed cases of lead poisoning as Neely, the analyses of the Central organs were undertaken by Allen, & he found no lead in the Brain.
be heart, doublet pains in the kidneys, but a very minute quantity in the liver and spleen, in the liver and spleen, sickness of the veins yielded as much as 1/10 of a gram of lead.

Authorities differ much as to the manner and compound in which lead is absorbed. Falsch is of opinion that if precipitated, peptic and so hindered by mastication. Mihalski thinks that all lead compounds were changed into chloretates in the stomach as so absorbed. Above cannot be arrived at this conclusion because it is eliminated as an carbonate by the urine. Another theory is that if precipitated albumen in a greasy mass on the surface of the alimentary canal, so preventing absorption and inducing malnutrition, anaemia etc.

I think the most probable theory is, that when lead is introduced into the body, it forms a compound with albumen and is absorbed as an albuminate, and that this albuminate has no extinguishing properties.

Lead having been absorbed, the common theory is that it acts especially on muscular fibres, the muscles of the blood vessels, intestines and bladder suffering most. By contracting the small blood vessels increased blood pressureresults and hence the hard pulse. The anemia, the cachexia, and the other disturbances of organs: the anemia of the brain, causing the convulsions; the contraction of the blood vessels in the muscles, together with the firmness of the muscles of the muscles themselves, causing the palpitation; and the contraction of the small bloodvessels of the intestines, together with the firmness of the muscles, causing the cold, and as lead is eliminated by the urine, they consider that the purgative character of the symptoms are due to a temporary diminution of the quantity of urine causing temporary accumulation of lead in the system. This simple superficial theory does very well, but unfortunately it is not borne out by facts. For we should expect, from the contraction of the bloodvessels, and increased blood pressure, to find hypertrophy of the heart, especially the left ventricle, a physical fact which is certain in common as usual. The liver also we should expect to be universal.
and not confined to one portion of the body, and the principles of muscle action seem to be more general and not particularly localized as it is. Some cases may be very rare, others from this they are always suspect than other common symptoms.

For these reasons, I should discard altogether this very general theory of its action, especially in cases of undiagnosed muscular foci, as the pathological cause of the symptoms, and look for some theory with less objection.

Post mortem examinations have given so little strongly negative results. No changes have been observed in the brain or abdomen beyond normal injection. No constant history of cases of other change in the brain, kidney, or the bladder. In some cases, the liver has been found contracted and retracted, but this is not due to the special action of lead on the blood vessels in it, and the kidneys, especially in these cases, have been found contracted and granular and just about the same cause. But I do not think there is any sufficient evidence to warrant us in concluding that lead, close of itself, acts in that way on either the liver or kidneys. Other causes can, in almost all the cases recorded, be found to account for this condition. Lead appears to be chiefly eliminated by the kidneys, especially if albuminuria be present, as a chloride, also by the bowel. It is clearly come to be eliminated by the mucous membranes and skin. In support of this elimination by the skin, it is recorded that the water of a bath, in which a patient suffering from chronic lead poisoning had been treated, was found to contain lead. But from careful experiments I have made, I have failed to confirm this, and I am inclined therefore to think that the water of the bath contains previously contained lead, or that particles of lead adhered to the skin, and became dissipated into the water, or that the alleged results. Therefore it may happen that if any lead is eliminated by the skin, it is stated, that if a patient...
suffering from lead poisoning be immersed in a warm bath of alkaline sulphides, lead could be extracted in the surface of the body as a black sulphide, but it is found that the bath must be made of copper. In the effect is not produced. The clearly shows that it is not due to lead as all but in the sulphide of copper that is produced.

Quinacridone considers that lead circulates slowly, becoming distributed and eliminated in nearly equal proportions, the an increase these causes an arrest in the elimination and so brings on the symptoms. This certainty is not always the case, for symptoms may begin long after exposure to lead has ceased. In each slight element it is Dr. Davenport of the alimentary canal may bring them on. Of course in some cases an extra dose of lead may check them too deeply, but it is by no means the only cause.

With regard to the special pathology, it will be most convenient to consider it under the heads of the most marked symptoms, and to commence with the Blue line on the gums.

According to many authorities, among whom may be mentioned Winckel, Fugger, Dr. Elms,among many others, this peculiar blue line is caused by the action of the Sulphuretted Hydrogen, contained in the portion of the teeth, on the blood, or in the Decomposing fluid around and about the teeth, acting upon the lead in solution circulating in the capillaries of the gums, forming the black sulphide of lead, which appears on the gums at their free margin as a blueish line. This blue line being in the tissues of the gums itself.

After a careful examination of a number of cases, and a few experiments on the gums in these cases, I have arrived at quite a different conclusion. I was led to question this theory from the fact that when the teeth had been extracted or were absent, the blue line abruptly disappeared, and further that on the most careful cleaning of the teeth of all lead for a continued time, and after all other symptoms of lead poisoning had completely disappeared, the blue line still remained.
Still farther, I found that by gently separating the gums from the teeth, and applying dilute acetic acid into the space thus formed, the blue line slowly disappeared, the reason being, I believe, that this black sulphide dissolved by the acetic acid and became a colourless solution of lead. Therefore, come to the conclusion that lead must be first introduced into the mouth in some form or other, and there being a decided interval between the edge of the gums and the teeth, the lead directly passes into this space, and the precipitated hydrogen of the breath a decomposing gas, or contained in the breath, passes also into this space and then acts upon the lead, forming in this space the black sulphide of lead, which shows through a black colour, and as this interval between the gums and the teeth is equally limited in extent all along the margin, the blue line assumes its peculiar shape, namely, a line. In the case where the 10th tooth has been extracted, there is not this space a interval, consequently there is no lead to be acted on, and therefore a break occurs in the blue line. There cases where the blue line is exhibited most clearly are those where the teeth are most neglected with regard to cleanliness; in these cases also the gums are more spongy, or the teeth more cavious, and there is a decidedly greater interval between the gums and the teeth, consequently greater room for a deposit of lead, and this deposit is more easily acted on by the precipitated hydrogen. In these cases when the teeth are kept clean & the gums are sound, the blue line does not disappear, simply because the lead does not penetrate into the space mentioned & clean out the black sulphide therein contained. This theory accounts exactly for the fact that the blue line is the very first & last symptom to appear & disappear, indeed it may be seen long after the gums have come into contact with lead & it appears years before any other symptom is complained of, because the very first part of lead then enters into the mouth will come into contact with
with the depth of 20 years into the space mentioned.

The Cotic:

This also has given rise to many theories. According to D. Hutton, Faye, and Deus & others, the cotic is produced in the following manner: the black sulphide of lead is produced in the intestinal mucous membrane by the action of the sulphuretted hydrogen contained in the intestinal gases, upon a soluble compound of lead contained in the blood within the capillaries of the villi of the intestines. A marked extenemic blackening of the bowel is produced, as observed in some post mortem. D. Reavenon analyzed this blackened portion, and compared it with a portion of the unblackened bowel in the same person, and found excess of lead in the blackened portion amounting in some cases to 320 times the quantity found in the unblackened portion. They therefore consider that the deposition of the sulphide of lead in the mucous membrane of the intestine, to be the cause of the cotic, by its action chemically and mechanically upon the endorgans of the sensory nerves. This theory supposes the lead not to be circulating in the capillaries of the villi, but to be then acted on by the sulphuretted hydrogen in a manner exactly analogous to what was seen in the guinea-pig, which I have shown to be probably wrong. Now as there is by far the greatest quantity of sulphuretted hydrogen in the large bowel, we should expect a greater amount of blackening there, and that the large bowel would be the seat of the cotic. But as for the supersensitive part and that of others, amongst whom may be mentioned somehow, the cotic is almost always in the small bowel, and the blackness does not appear as much in the large as the small. Therefore it is that I discarded this theory altogether, and I further consider that the action, in thickening, is constructive, can not be due to the action of lead, are caused not by lead at all, but by some local inflammatory of the bowel from other & totally different causes. Moreover, if this latter were the
cause of the colic we should expect it would be increased by pressure methods of which it is relieved.

In my opinion lead has no particular or definite local action on either the coats of the intestines, or the endogynus of the nerves of the intestines, as described. The blackness seen in the intestines is probably due to an excess of lead taken i.e. more lead taken into the alimentary canal than can be eliminated, for in many cases of colic this blackness has not been observed, although lead existed known by the
Kussmaul & Meyer are of opinion, this excess of lead may cause the sclerosis of a certain amount of fatty degeneration of the muscular fibres when it exists, but I think other causes could more easily account for all the signs of local inflammation.

I am strongly inclined to conclude that the colic is produced by some peculiar specific action of lead on the nerves of the nervous supply of the small intestines, which at the same time produces temporary paralysis of its coats and causes the extreme constipation of colic.

I do not think there is any obstruction in the intestines causing the constipation but temporary paralysis, and consider the cause of this is central or not peripheral. I do not think the peripheral endogynus of the nerves supplying the bowel or the muscular fibres of the bowel are concerned but the paralytic action of the lead is on the centres from which proceed these special intestinal nerves.

The fact of pressure relieving the colic is not against this view for many central neuralgic are relieved by pressure.

We know, if the splanchic be stimulated the peristaltic action of the small intestine (or the large) is stopped, and I believe lead acts upon either the centre of the splanchic, stimulating it, producing the colic constipation, and finally the paresis of the bowel, or it acts as will be shown more clearly later on. Speaking of the pathology of the Pelvic upon certain portions of the grey matter of the spinal cord from which filaments are join to the sympathetic is relevant to the
Splendamie, and as produces the Colic. This latter theory I think
by far the most probable.
In those cases of constipation without colic, I conclude the substance
of the lead to be slight on this central portion. Whether a very
any actual morbid change is produced in these centres, and what
is its nature, Post Mortem have not yet shown; but I think
some change will at some future day be found to exist,
and it will then account exactly for the nature & position
of the Colic.

The Arthralgie.
The peculiar kind of symptoms caused by lead bears a striking
opinion in my mind and analogous manner to that in which Lead
of Rheumatic pain acts upon the joints. Lead causes the blood
to become impregnated with terebene by preventing the conversion
of acetic acid into urea, and this, as in gout & rheumatism, sets up
the arthralgie symptoms.

The Palsy:
There are three main theories advanced to account for The
Palsy, namely: 1st The Muscular.
2nd The Nervous.
3rd The Spinal or Central.

The Muscular Theory:— This theory is probably derived from the
Post Mortem changes found in the paralyzed muscles, namely,
the marked atrophy. The muscle is found to be shrivelled and
granular, and there is an abundant amount of connective tissue
which is probably the empty sheaths of the muscular fibres. Also
the fact that lead is found in the muscular tissue and is supposed
to accumulate there. Further, there is the supposed changes in the
local circulation in the muscles, though I am afraid a close demonstration
disproves this. These changes in the muscles mentioned do not
account for the frequent insensitivity of certain muscles, so
for instance, the Suprinate then being involved in the paralysis of moderate changes. Guernow is one of those who adopt this muscular theory. He considers that lead induces Demise of the muscular tissue, which loses its capability of staying upon nerves. The nature of the disease induced he does not know, nor the deposit of lead is localized in the muscles, the true nature of the changes in the muscular tissue, he does not attempt to explain. He considers that lead acts in the muscles directly, not through the medium of the nerves and hence the Paralysis. Still he is of opinion that the muscles are always affected before the nerve centres. But one of these observers attempts to explain why certain muscles are affected and not others, especially why the Suprinate so often escapes.

2. The neuritic theory: Ferrier administered salt of lead to the lower animals, and found that the most constant appearance was a peripheral neuritis, more especially observed in the nerves of the flexor muscles. Why should the Extensor Communis Dijftorum be so rarely affected? why other muscles supplied by the same nerve branch? he considered that the extensors and abductors were physiologically weaker than the flexors, and came under way less vital than the flexors. I believe he derived this knowledge from certain experiments conducted by Dumas in reference to the excitability of nerves after death, when it was found that the Extensor Communis Dijftorum possessed the least vitality, therefore soonest gave way to the destructive influence exerted on the peripheral nervous influence in general; the destructive influence is the one being lead.

But I do not see how this accounts for the peculiar distribution of the palsy. In a genuine peripheral neuritis muscle, as it progresses, affects all muscles without distinction, although it may commence at the 2d or 3d week. Clinical observation does not bear this out in my experience. Dr. Rossini found that the peripheral nervous system was quite
unchanged in acute case of lead poisoning, and I should expect the same in protracted cases. Moreover, if we can accept the theory of a localised neuritis, we must believe that the neuritis is strictly limited to certain numbers of the motor fibres of the same nerve, the lead picking out these fibres supplying certain muscles and not affecting certain fibres in the same nerve supplying other muscles. This I think is rather hard to believe.

3rd. Spinal or Central Theory:—

In an early part of this Thesis I mentioned that a full, careful, and complete post-mortem examination of the central nervous system had not been made in any case of death from chronic lead poisoning, in which the peculiar jitters were manifested. Z muster has certainly described the post-mortem appearances he found in the spinal cord in an ordinary case of lead poisoning, with jitters, but it is not very satisfactory. He states that corpora amylacea were seen in the lateral anterior spinal roots, and in the spinal cord itself, especially the posterior columns. The fibres of the nerve roots he found smaller than usual. In the cervical region the grey matter was of normal shape. In the dorsal region from the middle downwards the left anterior columns were smaller and atrophied. A great number of corpora amylacea were found. The anterior horn cells were smaller than those of the opposite side, in part completely disappeared. In the cervical and lumbar regions the multipolar ganglionic nerve cells were smaller and darker than normal, destitute of broad processes. In the lower part of the cervical region was a small microscopic focus of sclerosis. It therefore appears from his observations there were certain changes in the spinal cord.

Dr. Poirier after a number of experiments with lead on animals in the laboratory of Professor Fremejewsky, found in microscopic examination of the spinal cord, marked changes produced in acute cases of the character of acute encephalitis. In more
protracted ever, these changes were not merely confined to the grey substance, but invaded the white substance, and produced changes similar to those observed in diffuse myelitis.

It is not maintained here that it is absolutely necessary that there should exist gross morbid changes in the cord to account for the paralysis. Lead may act here as it does in producing hemiplegia, or as a destroyer of tissue, but as a modifier of nutrition or molecular organization, leading to diminished synaptic influence of the cord and suspension of its functions.

If mercury or arsenic may give rise to peculiar nervous symptoms without producing evident lesion to explain them, why may not lead? If we look at Landry's ascending paralysis, in which almost every activity of the cord is suspended, we find no gross or apparent post mortem appearances in the cord, and the same may be said of chronic local neuritis. These can be attributed to a functional disturbance of the grey matter of the cord but the exact nature is not yet known. There is no reason why lead should not produce similar changes. So that at the least, it is not necessary, as some maintain that lesions apparent to the observer's eye should exist in the cord in support of this special theory.

This objection disposed of, let us consider carefully the nature of the paralysis which occurs in organic diseases of the anterior horn of the grey matter of the cord and definitely in such diseases as infantile paralysis and in the corresponding lesions, acute or chronic. Adult, i.e., acute or chronic atrophic spastic paralysis. We shall at once be struck with the extraordinary analogy which exists between these and lead paralysis. Many cases are recorded of Drop avid, in which only the impossibility of tracing lead compels the observer to diagnose anterior Disease myelitis. De Molinii
Erbs, Bernhard & others have specially described such cases. It is from a consideration of these cases, & contrasted them with cases of true Lead Paraly which have been under my care, that I have adopted this special theory.

Let us see what actually takes place in lead Poison. As a rule, the hand cannot be extended on the forearm & the first phalanges cannot be extended on the metacarpal bones, thus the hand, when held out in the same position, hangs down helplessly, & the so-called "drop wrist" is produced. The only movements possible being slight flexion & extension of the distal phalanges of the fingers & thumb. Definite groups of muscles are here involved, as may be shown especially by electrical reaction, & amongst the groups commonly involved the Supinator Longus is in each. Duchenne was the first to point out that the Supinator Longus was never affected, & he dwelt upon this fact as a diagnostic symptom of Lead Paraly. But we know this is wrong, for in some cases of Lead Paraly the Supinator Longus is affected, & when it is affected, it is found that a different and distinct group of muscles is also affected. I would especially draw attention to this fact from three cases that have come under my notice. These carefully verified it. This non-involvement of the Supinator Longus amongst a group of muscles anatomically in close proximity to it, is also the case in some other forms of palsy. The exact pathology of which is known. Thus in Circumscripted cervical anterior poliomyelitis, i.e. inflammation or denervation of certain portions of the anterolateral grey matter in the cervical enlargement, or more especially if certain groups of large multipolar ganglionic nerve cells contained in the anterior horn of the spinal cord, B of Jolly may be seen. Experiments have shown that
The anterior horn of grey matter, containing these multipolar or ganglionic nerve cells, is the centre for flexion and extension. Here these cells being arranged in groups, move in a less independent of each other physiologically, group of fibres to the anterior horn or motor roots, which unite in a network in the cervical, lumbar, or sacral planes. The nerve roots issuing from these planes contain therefore fibres derived from several roots that is, from several nuclear spinal centres. It is on this account, that when the lesion is localized in certain spots of grey matter, some muscles supplied by a single nerve may be affected while supplied by the same nerve may escape. And this I think explains very clearly the immobility of the Superficial group, if escapes, because being a flexor, its central nucleus is probably intimately connected with that of the other flexors but with the extensors; and this would further explain the fact that when, in Acute Poliomy of the Superficial group is affected, we find the Flexor Group (Biceps & Brachii, Anterior) also involved; conversely, if the Superficial group is not affected the other flexors named are also not affected. It requires very careful electrical examination to make this out clearly, especially in the early stages, for as Duchenne, Stock, Buzard, for others have shown, the electro-muscular sensibility may be lost while motion can still in many cases be produced by the will of the Patient. According to this theory, the Flexors of the Forearm & the Extensors of the arm, are under control of separate centres placed at different levels in the Cord, through different roots of the spinal cord; this has been further demonstrated by the following experiment. If an eliminate the
5 ½ 6 ½ cervical roots, at a point where the nervous bundle appears between the Petuni, we find that besides the Deltoïd, some scapular muscles, the Biceps, Brachialis, Anticus, Sapiunius longus contract, but the extensors of the hand & fingers remain quiet. Several cases are recorded of lesion of these 5 ½ 6 ½ roots with this peculiar & definite group of muscles paralyzed. Therefore I think it is clear (since the same group may be found paralyzed in Lead Palsy) that the spinal centres must be affected primarily, or their roots before they reach the muscles, by the action of the Lead.

We have seen, therefore, that when the Supinius longus is affected the other flexors together with some scapular muscle, & the Deltoïd are also affected; the reason being the close relation of the nuclear centres of those muscles supplied from the 5 ½ 6 ½ roots. In cases of Poliomyelitis & Infantile Paralysis, the distribution of the palsy is also common, & so Thiene said the pathological changes in the cord in these two diseases is perfectly well known. In those rare cases of Lead Palsy in the lower extremity, let us more what is the palsy, we find certain groups here affected, and these groups present a strict analogy to the groups affected in the upper extremity, & in Poliomyelitis. Thus we find that when the flexors & extensors muscles are affected, the Tibialis anticus escapes, & when the latter is involved the extensors of the leg are also affected. Thus the Tibialis anticus corresponds to the Supinius longus in its escaping amongst the muscles supplied by the leg from the cervical nerves. It derives its supply from the 4th & 5th roots of its nucleus is in close relation to that of the extensors of the leg.

I do not think then it is difficult to come to the
Conclusion that, from the great analogy that exists in weakness between Paralytic and Infantile Paralysis, on the one hand, and Diplegia on the other, there is a pathological unity between them.

Further there is a similarity also between Lead Palsy and Progressive muscular atrophy, a disease always looked upon as spinal. Indeed Delpech has shown that the latter disease may be caused by asparagine. In a case of Progressive muscular atrophy recorded by J.Mitchell, involving the right forearm, there is a most striking analogy, thus: The extensors of the wrist with summunity of the Supinator longus, the extensors of the fingers or the small muscles of the hand & long flexors of the fingers were involved, a group of muscles shown clearly by careful electric examination to be often affected in Lead Palsy.

It used to be thought that the long flexors of the fingers escaped in Lead Palsy, but this has been disproved by the peculiar reaction of Upstrecthm, obtained by carefully applied electric stimuli. Tremor considered as due to the close proximity of physiologic connexions of the Spinal centres of the long flexors of the fingers & the interossei, when these latter are affected we should expect to find the latter also show signs of Disease & this has actually been found to be the case in Lead Palsy.

Roussel describes carefully a case of Sub-acute Spinal Paralysis in an adult, in which a particular group of muscles was affected. Thus if the right extremity part of the extensor communis was paralysed and in the left extremity the Deltoid, Biceps, Brachii, Antecrurals & Supinators longus were more paralysed & atrophied, a group precisely the same as those shown to be paralysed...
in Lead Poison. He also records a case of Lead Poison with exactly the same group of muscles affected. From all these facts stated, I think that the evidence of a spinal origin of Lead Paralysis, & the exact locality of its action being in certain nuclear centres in the anterior horn of grey matter is irresistible. This theory entirely accounts for the peculiar groups of muscles affected, which no other theory appears to attempt to explain; and I think that we must look for the primary pathological changes, whatever they be, in the typical cases of Lead Poison, in the nuclear cells giving origin to the 7th Cervical nerve root, 2nd in those cases where the long flexors of the fingers with the small muscles of the hand are affected, in the nuclear cells giving origin to the 1st Cervical & 1st Dorsal nerve roots; and 3rd in those cases where the shoulder muscles with the flexors of the arm are affected, in those nuclear cells giving origin to the 5th & 6th Cervical roots. All three groups being situated in separate & distinct parts of the anterior horn of grey matter of the Spinal Cord.

The Encephalopathy:

With regard to the pathology of the peculiar paralyses of symptom to which this name has been given, Klemmer, as in all the other forms of Lead Poisoning, states from his own observations, for not having seen any case of it. There has been opportunity of studying it. It seems to be rather micronesia & look for its true pathology in acute or chronic nephritis. During the course of which disease, Lead must doubt exert its toxic effects, hastening perhaps their fatal result. In those cases recorded by observers, Pathomorphs have generally shown the principal Kidney; and I think their symptons resemble Acute Poisoning from nephritis more strictly than from Lead.

Poisoning. In these cases, they have strangely failed to find any
trace of lead in the central organs of the nervous system; in
 verdad, one would not anticipate if lead were the cause of
the symptoms, but would rather expect to find some lead
there above all places.
Symptoms:

The time which elapses after exposure to the sickness and the onset of any symptoms is very uncertain. The first effects can very slow to appear, and being obscure are easily overlooked, and sooner or later certain general symptoms may be noticed, such as an impaired nutrition, a changed systemic aspect. The skin assumes a peculiar yellowish color, or a rusty tint. This yellowness is due to the presence of jaundice. There is frequently a mild scurf like ike in the mouth of an adjoining nature, with flat breath, anorexia, and some dyspepsia. This may be shown by the pulse, some chillsiness & some weakness of the body, especially of the muscular system.

A very important symptom, which is almost certain to appear early, is the peculiar Blue Line seen along the margin of the gums next to the teeth. Sometimes the gum is involved even the mucous membrane of the lips, especially the lower lip where it touches the teeth, may exhibit patches of very considerable sizes of a dark blue form. Sometimes the gums of only a few teeth are affected, namely the incisors & canines. Sometimes, this blue line is broken in its continuity, but when this is the case, it is found that at the broken part of the line there is an absence of a tooth or teeth. The line varies in size & intensity in different cases. In those in which the teeth are most carious, the line is most marked. The opposite being the case in sound & well-kept teeth. The gums in these cases are also more spongy, & edematous, & bleed very easily on rubbing. The peculiar Blue Line is not only the first symptom to appear, but it is also the last.
to disappear. Indeed it does not disappear often for months after the patient has ceased to be exposed to the lead poison. It is further a symptom, in my experience, always present, and it may be the only one. I have recently examined some 300 men, who daily work with white lead, and found this blue line in almost every one of them more or lessdeveloped, although few complained of any other symptom but this. These general symptoms of the influence of continued exposure to lead may stop here, as they often do, or they may go on to:

1st Cotic.
2nd Arthralgia.
3rd Palsy.
4th Encephalopathy.

These groups of symptoms may occur quite separately from each other, or more or less together in the same individual. According to a Table by Janguerl Des Planche, they occur in frequency in the order named. The Table is as follows:

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cotic</td>
<td>1217</td>
</tr>
<tr>
<td>Arthralgia</td>
<td>755</td>
</tr>
<tr>
<td>Palsy</td>
<td>127</td>
</tr>
<tr>
<td>Encephalopathy</td>
<td>72</td>
</tr>
</tbody>
</table>

This is a convenient Table to consider them separately in the order named:

1st Cotic.

This may be sudden or gradual in its onset. There may be certain wandering pains about the abdomen, either worse after a meal or affected by food, or you may have all the symptoms of acute hypopnoea preceding it. Along with this there is usually constipation often most obstinate, though I think very rarely, diarrhoea may be met with. Then appears the Cotic.

The changes and pimples are seen indeed. It does not appear to
be relieved by pressure but is sometimes relieved. The seat of the relieving pain is usually the small intestine. There is usually retraction of the abdomen, and it is often hard but very rarely tender. There is often great pain in the back. Fainting with great distress and retching is common with Bilious vomiting, although in some of the worst cases I have seen there has been no vomiting. Some inclined to think the vomiting is in most cases sympathetic. The appetite is gone. There is usually no fever. The urine is strong and scanty, and sometimes slightly albuminous. There may even be retention of urine. Sometimes also there is great tenesmus.

The pulse is diminished, dull, and slow. The respirations quickened. The symptom is often worse at night, causing severe delirium. They may last a week or less. Recovery is rapid, especially if the bowels are made to act freely. The same individual may be subject to Bilious colds, & may exhibit nothing further of the effects of the cold. It is frequently an early symptom of it is the most likely to occur of them all. The constipation is often very peculiar in being most obstinate & difficult to relive. I have seen it last 10 days before it could be relieved, and then not before an abundant amount of evacuations of the strongest nature had been given. It usually precedes the cold for several days, together with the usual signs of dyspepsia.

2. Arthritis:

This appears as an affection of the joints very similar to that of Rheumatism or a combination of the two. Indeed I have at a very young age. The same thing for it is produced in almost exactly the same manner, namely by the presence of uric acid in the blood. There is often a certain amount of swelling & inflammation of the joints, with great tenderness. There is a burning, burning, pain in the joint, subject to remissions, & the muscles are the joints
are often affected, thus in the case of the knee joint, the flexors are most affected, a kind of cramp being experienced in these muscles. They may occur in any of the joints of the extremities but generally the lower ones are affected. There may be no other constitutional disturbances such as constipation, fever, alteration in the pulse, temperature &c. but simply & solely the affection of the joints. The Blue line on the joint is always marked in these cases as it is in all the forms of lead poisoning.

3rd Palsy.

There are usually some premonitory symptoms of the approach of the palsy, no matter whether it occurs in the upper or lower extremity such as weakness, tremor & shocking pains in the muscles, with some numbness & atrophy. In the case of the upper extremities, one or both hands become weak, this weakness increases, passing into actual paralysis, when the so-called Deep Trigeminal Nerve results. Most usually the extensors of the wrist & fingers are paralyzed. The hand cannot be extended on the arm, nor the joint phalanges on the metacarpal bones. The hand held out in the prone position hangs down helplessly, the only movement possible being weak flexion & extension of the little phalanges of the fingers & thumbs. The Supinator longus often but not always escapes. In order to ascertain if the Supinator longus is affected, tell the Patient to flex the arm, whilst the Observer rests the misses by holding the limbs in a position mid-way between pronation and supination, if it is unpianied the belly of the muscle stands out as a hard triangular mass at the bend of the elbow. By far the most important test however to show what muscles are affected is the Electrical test. If this require, great care in its application, for if I have shewn, muscles not complained of at all by the Patient
may be found by the stimulus of electricity to be extensively
spread. It is not with the induced currents that these results
may be seen but with the constant current, and with a careful
examination with this constant current; certain definite
groups of muscles are found to be affected, as there shown fully
in speaking of the Pathology.

Deep seats may be single or double. The lower extremities may
also be affected. The groups of muscles involved in them
are definite and strictly analogous to those of the upper
extremity. It is rare to find the Respiratory or Spinal muscles
affected. Whatever muscles are affected great atrophy of
them rapidly results.

Encephalopathy.

The true symptoms under this heading I am sorry to
day have never met with, or if there, it has been done
so incalculating. Therefore I must rely upon the report
of other observers. It appears to be the most grave severe
form of lead poisoning, and generally terminates rapidly
in death. There is generally violent headache, deafness, and
anaesthesia, some dizziness, stupor, apathy, general or
partial convulsions, resembling epileptic seizures but
having no aura. Between the attacks there is great
numbness and delirium. Often there is hypesthesia euphoria,
great thirst, dry, thickly fused, tremors, by no means,
intermitent symptoms. Consciousness may be lost early. There is often a
dread of being moved. Trembling of the head to & fro, tachycardia
of the face, a raised temperature, small, fast pulse, thready
& shallow respirations. Sometimes most urgent vomiting
stretching sides of the mouth, picking of the bed clothes, exhaustion
come of death. It is curious that in most of the
cases recorded there are marked albuminuria, and in
The post mortem was found primary kidney. It is there stated.

I believe that the granular kidney is acute or chronic nephritis with albuminuria previously excited, and that the lead poison merely aggravated them & hastened the fatal result of this kidney complication.

A form of delirium is said sometimes to be set up by lead. Delirium, dementia, symptoms, very difficult to distinguish from delirium tremens are met with. It is my impression that in the Keighley case death was due to the kidney disease found to have existed, not so much due to lead poisoning although it is easily understood that it might have been accelerated by the exposure to lead.
Course, Duration & Termination:

These vary according to the peculiar idiosyncrasy of the patient, and to the amount and length of time he has been exposed to the lead. Thus I have found that the smaller the quantity of lead used, as in the case of the painters, the longer the time the symptoms in showing themselves, the more do they resemble the arthralgic type. In the case of the "body-makers," here, who use large quantities of pure white lead, the symptoms come on early after the first exposure, and they assume more the forms of Cotic & Palsy. These are between 200 x 300 painters here, many of them exhibiting the cachexia & blue line, yet it is rare to find them suffering from Cotic or palsy. It is usually some considerable time before any symptoms show themselves; it may be years or only months.

Amongst the "body-makers," I have met with cases of Cotic as early as 3 months after the first exposure. Amongst file-cutters, it was found, that the average time from the first exposure to the first symptom was about 14 years. The Cotic has hitherto occurred as early as a month. It may last from a few days to a fortnight, and it generally terminates favourably. The arthralgic symptoms are usually late in appearing and favourable also in recovery. The Palsy is also a late symptom, occurring after many years' exposure. Cases of Palsy are usually from 3 to 5 months under treatment before recovery takes place, a case is recorded in which a patient used a hair used containing lead for 4 years before any symptoms appeared, then treatment of the virus was the first. The hair was then continued for 2 more
years pully resisted. The termination of the Pully is as a rule very favourable. The so-called croupy cases are most rapid in their course, generally and fatally. They occur often very early after the first exposure to the poison. Death is recorded as occurring within one or as early as a few days after the first symptom.
Diagnosis:
The first effect of lead poisoning are easily confounded with acute Dyspepsia, but the blue line on the gums are the history must be the guide. True Jaundice must not be mistaken for lead poisoning of the skin, seen in some cases of lead poisoning, especially among women exposed to chronic use of lead. The peculiar nature of the cuticle, its relief on pressure & its accompanying symptoms will lead to its true nature. Arthralgia can only be distinguished from joints rheumatism from the history. The paralysis is most important & sometimes difficult to diagnose. For as above shown, some cases of Infantile paralysis, acute, subacute, chronic spinal paralysis, of adults, progressive muscular atrophy, juvenile paralysis, or early paralysis, simulate lead poisoning so closely, that only the history of exposure to poison can determine what is the true nature of the disease. Injury of the Radix & musculo-spiral nerves can easily be diagnosed by means of electricity. The cerebral forms of lead poisoning must also be distinguished from Delirium Tremens, Chronic Alcoholism, Epilepsy. Cerebral cases & some forms of insanity, & above all, if it is possible, from Mangan poisoning in Chronic Night Disease. The history must guide us. There is not one true diagnosis symptom peculiar to Chronic lead poisoning of any real importance. Therefore careful attention to the history is ever important.

Prognosis:
As a rule, Chronic Lead Poisoning, if uncomplicated, rarely results fatally, unless the symptom are those of Saturnine Encephalopathy so-called, which is rapidly fatal. The other three forms almost always give way to treatment promptly.
Treatment:

Perhaps the most important of all the preventive means that can be taken is cleanliness. Frequent baths, warm or cold, especially the former should be used with plenty of soap. A sulphur bath once a week would be very beneficial but cannot always be conveniently obtained. In the case of white lead fabricators, no one should leave their work without first taking a bath. The hands should be thoroughly well washed and the nails carefully cleaned and filed (not bitten as is so often the case) before taking any food. All hygiene rules are most important and should be carefully kept during work. Eating and drinking in the workshop should be strictly prohibited. The clothes should be changed before leaving work, and the shoes should be well ventilated, not only after work is finished, but during work hours. Muslin respirators should be used by workers, and whiskers and mustaches in men should be allowed to grow as they prevent to some extent the inhalation of lead particles. The shoes should be kept well swept and scrubbed. The clothes worn at work should be frequently well brushed and beaten. According to the French regulations, and I perfectly agree with them, plenty of slightly curdled milk should be drunk, and not any weak acid drinks, such as weak sulphuric acid drink, because it forms the sulphate of lead which is capable of being absorbed and is poisonous. Solid provisions and acid foods should be avoided. There should be a periodical medical inspection insisted upon. The law should prohibit children and young persons from entering mines etc. Every one employed should have special clothes, caps, etc., to wear solely during their work. In the case of poisoning by glazed
earthenware vessels, if such vessels were subjected to the direct influence of a flame, or in other words singed, they would be rendered harmless. Certain innoxious forms of true and daylily paints and pigments could be used quite well to replace white lead in some of its largest uses. The water supply should be very carefully looked to, as it is a very frequent cause; various well known remedies should be used to prevent as far as possible water absorbing lead. Charcoal filters are not sufficient in some cases, to remove lead from water. The storage of water is also very important, and must be safe, leaden cisterns must be avoided.

Direct Treatment:

In the earlier stages of the disease, that is to say, before any of the well marked cardinal symptoms have appeared, the patient should be required to have his work entirely for a time, and to have an adequate change of air, tonics, and frequent baths especially Turkish or Turkish baths. Plenty of good light, plain and nourishing food, with an especially good supply of new milk. Cod-liver oil in some cases would do good, and the injudicious use of the Periode of Iron might be found a convenient tonic. A dose of Sulphate of Magnesia combined with either Perina or Jalap should be given at the commencement. If the bowels are habitually inclined, I would strongly recommend the use of Cascara Sagrada. There is a cure in a few cases of habitual constipation in chronic dyspepsia, with the best results. The form of preparation there used in these cases has been the Retail Extract. The Ther with a pill composed of one grain of the solid extract of Cascara Sagrada combined with half a grain of extract of Nux Vomica, every night before going to bed. It must be continued 3, 6 or 5 months if necessary till the bowels are brought to act regularly. Cascara Sagrada is said to act by increasing the perspiration.
action of the bowels, and as, in my opinion, the constipation of chronic lead poisoning is due to a want of tone or partial paralysis of the coats of the intestines, this led to try if a certain mixture would succeed. It is stated however that in a few cases it has not been well tolerated, but in none of my cases have I met with any unpleasant symptoms from it, probably because there was given it a sufficiently tonic mixture.

If the symptoms have passed from this stage to that of colic then more active measures must be resorted to, and here I would call especial attention to the absolute necessity of obtaining thorough relief of the bowels. It is, in my experience, the first object in cases of a very difficult one to accomplish, but once effected the recovery is rapid, no doubt because the nervous supply of the bowels is restored to its normal condition and the peristaltic action set up, besides this, any surplus lead in the intestines is got rid of by the great absorption that takes place. It is therefore my custom to give at once a full dose of sulphate of magnesia combined with either some or jwolf. This may fail in acting often because it is vomited, but not always. This, together with the bath and an emulsion of hot water and castor oil. This also I have found to fail sometimes. Then there gives an ounce of castor oil internally and hot baths externally. The good action of the bowels is often slight, but once they are moved it is not difficult to keep them open. In the case of a young man aged 26, who came under my care early in my experience of lead came with constipation. The only constipation seemed to be the only symptom, indeed there was no vomiting or constitutional disturbance whatever, from him first giving an ounce of sulphate of magnesia, with 30 grains of powdered jwolf with no results, then I gave him a large dose of hot water and latterly an ounce of castor oil. With no results. Then gave him 10 grains of the Medicine Castor and I gave him pills, but all did me good. I saw
Then some gamboge pills & 2 drops of Creta oil; afterwards a dose of
Sula & Seneca and there was slight action of the bowels, but very slight,
in further dose of Creta oil caused the bowels to be freely opened.

The elae requisites disappeared, the patient resumed his usual work
in a week after the bowels were first opened. The curious fact in
this is, that there was no constipation throughout, underlying all
this man of aperients was retained, and no constitutional
symptoms resulted from it. The constipation in this case
lasted exactly 10 days, and the form evacuation of the bowels
was soft & liquid nature, being no appearance whatever
of obstruction, the act of action was more liquid but no Phaenomena
diarrhcea. I believe there was little perigos of the muscular coat
of the intestines with great irritation of the sensory nerves. There
exists this case in order to show the extraordinary amount of
strong aperients that can be given and with so little danger in
these cases of True Lead Case with Constipation. But I would
not venture to recommend that such drastic aperients as
Pomolic, gamboge or Creta oil be used. I would depend more
upon Creta oil, sulphate of Magnesia, calomel, or the
bath enema, and I would strongly advise that in these cases,
and in those of the early stages the Curea Segrega be tried. Then
only used it in two cases, one of which it was successfully used.

Therefore I cannot speak very definitely of it. In the one instance
I gave 10 minims dose of the fluid extract every 12 hours
and at the end of the 4th dose there was a slight action of the
bowels, the 5th dose produced a very liquid action & I then stopped
it, the man recovered rapidly. In the same case we can
bowels were given with no effect & I then returned to the
treatment with the elae 20 minutes alone. It is my intention to
give the Curea segrega a further trial as the same it will
be found much more in the form of Constipation with Creta.
At the very commencement of the case I put my patient, if possible, on Iodide of Potassium, in doses of two grains every 3 hours, combined with Bromide of Potassium and Tincture of Belladonna; and if the case is very severe and death borne at night I placed Quinine in gr. 2. I do not place any reliance on external applications of such remedies as Tepid, sheep, mustard or scalding linseed. It is often the case that the first few doses of Iodide of Potassium produce an increase of the case, sometimes Iodine is produced, but I should not be disposed to stop it unless the Iodine was very severe. Iodide of Potassium appears to diminish the lead by the urine. It has been conclusively shown that during the administration of Iodide of Potassium, lead is found in the urine in increased quantities; and this proves at the Iodide of Potassium being given it did not exist in the urine. It is supposed that the increase of the case seen in the first administering Iodide of Potassium is due to the large quantity of Iodide of Lead set free into the circulation which at first is not seen. They do not agree with this, he considers that the Iodide of Potassium makes an insensible and of lead, which is freed in the urine, or to Iodide of Potassium rapidly prevents lead from being eliminated instead of making it. Kemmcr et al. agree with this; for I have most carefully verified the fact of an increased quantity of lead being in the urine as soon as the Iodide of Potassium is commenced, and this increases daily like recovery commences when it diminishes. Or, I may further consider that the Iodide of Lead found in the urine by the action of the Iodide of Potassium is inert. This is not the case, for there is no formation of lead that is inert. Certain that Iodide of Lead is not inert. Besides that if the Iodide of Lead is so formed in the urine, we should expect that the continued administration of Iodide of Potassium would not increase the quantity of lead found in the urine, and that in cases of death much lead would be found in the tissues, a fact which has not been observed, indeed a very small quantity of lead
as found in the cases after death in cases in which the Iodide of Potassium has been administered. I think it must, at present, be left an open question as to the exact manner in which it acts and in cases of Lead poisoning.

In my own cases I have found that if the Bromide of Phenolamine be combined with the Iodide, a much better and more speedy result follows especially in the relief of the colic. I generally give from 20 to 30 grains of the Bromide with the 2 grains of Iodide of Potassium of 5 minutes of Ammonia and 5 minutes of HCl to 5 ounces of water. The colic as the colic is of a nervous nature it is quite easy to understand how the Bromide of Phenolamine acts with such rapidity. Besides this, I have found that the elimination of lead by the urine is much more rapid in practice than in theory even when the Bromide is used in conjunction with the Iodide, then in those cases when the Iodide of Potassium is used alone.

I think that relief might also be obtained to some extent by the application of the Paradine current of electricity applied over the seat of the colic. I cannot speak from practical experience for I have not yet tried it. The electro-chemistry both has been recommended by some. In cases where the pain of the colic is unbearable, Chloroform may be given or a hypodermic injection of morphine might be tried. I should not advise giving Sulphuric acid to be given in any of the forms of lead poisoning as a drink for reasons I have stated. The diet should be light and nourishing, chiefly milk, mutton, chicken broth, beaten up eggs, a light milk pudding. If the vomiting is severe Porto wine bitter alone or in milk must be given. In this case also lime water may also be used. Stimulants of all sorts should be as a rule avoided.

Since Smith proposes to treat Lead Poisoning with Sulphate of Ammonia, he considers the first action would be a Sulphate of Lead, which will be discharged by the remaining Sulphate of Ammonia.
which is quickly eliminated. Theoretically this sounds nice and a tongue test might be made with it.

Drops usually that the saline treatment would be to give the sodium chloride, in hypodermic doses every 6 hours, because lead is eliminated as a chloride by the kidneys.

The Arthralgia.

The symptoms under this heading, are usually most readily relieved by local applications, such as hot fomentations, applying either of hot water alone or flaxseed, or cumbine flower syringe. A daily of fresh water, upon a quince juice, is of great benefit. If the after-effect of the treatment is more of a gain than than evolution, without initially of extirpation will be found necessary. Hot water for the feet is also very helpful. And of course rest is all important, the joints affected also should be kept well covered with cotton wrapping. The local treatment is much the same as to the other forms of lead poisoning. Potash water is a drink in especially useful.

The Palsy.

The careful and persistent treatment of this is very important, because it is one of those forms of local paralysis where treatment is generally successful. In the first place I would advise the patient having a mixture of boric and brassy combined with alcohol and iron water. Red wine, chalybeate tonics and plenty of good nourishing food. Locally I treated my earlier cases by galvanising these muscles only. This appeared paralysed, but the results, though promising, were very slow. Of late I have been more quickly successful by a more central application of the continuous current, combined with superficial application of the same current; that is to say. There is the Palsy according to what I believe to be its true pathology. One part of the current thus placed on the paralysed group of muscles, not only those muscles in the group complained of by the patient but
but those which showed the sign of weakness or depression, and
the others pule I placed one in the root of the 5th nerve to the 1st
Dorsal nerve, according to the groups of muscles affected. These
irrevocable cases, I place the pointed electrode on a point near the
posterior edge of the Sterno-mastoid muscle on with clone the
clavicle i.e. on the 7th cervical nerve root, and the other pule of the current
on the extensor muscles of the neck. In these cases when
the lower group is involved, the pointed electrode should be placed
as a point near the posterior edge of the Sterno-mastoid muscle
12 inches above the clavicle i.e. on the 5th and 6th cervical roots
the other pule on the sympathetic group, or its vertebral ending; and
most when the long flaccid of the fingers with the same
muscles, of the hand are affected, the pointed electrode must be
placed as a point near the posterior edge of the Sterno-mastoid
muscle, just above the clavicle i.e. on the 7th cervical and 1st Dorsal
nerve roots, the other pule on the muscular nerves. When the
lower extremities are affected the same principle must be
considered. At the same time I have tried Kymaphle
subcutaneously with much success, and it is astonishing what
large doses of Kymaphle may be injected into the paralytic
muscles without toxic effects, if only contain be mixed with
the first dose and the mixture gradually. This I think will
be found the best and most rational manner of treating this
palsy. These may need either a Codon or the affected
muscles in some form recommended; but no doubt friction
helps to restore their activity, especially as they are recovering.

The Encaphalopathy;

This means a grave re-curred variety of Chronic Lead Poisoning
requiring, in my opinion, exactly the same mode of Treatment as that
adopted in mercuric poisoning, i.e. Chronic or Acute Bright Disease
of the Kidneys, of which I do not consider comes under the title of this Thesis.