8. Lesions of the posterior part of the upper surface of the cerebral cortex of the rabbit may cause irregular alterations of temperature, which are quickly produced, and last only a short time. Sometimes the temperature falls, sometimes it rises, sometimes there are several rises and falls after one operation—characters very different from the rise of temperature produced after lesions of the corpus striatum.

9. Lesions of the crus cerebri cause a considerable rise of temperature.

No completely satisfactory explanation of these experimental results can at present be given. I have elsewhere¹ pointed out their bearing upon evolution and upon medicine. The facts that a minute lesion in the corpus striatum can cause a considerable rise of temperature, and that the rise only lasts some hours suggest that the effect is irritative, although the central nervous system does not usually respond to mechanical stimulation; still it is quite possible that in the case under consideration the effused blood and serum act as irritants, for we know that in man unilateral convulsions may follow hæmorrhage in the opposite side of the brain.

Most observers who have performed experiments with a calorimeter, and upon the amount of carbonic acid gas excreted, consider that the rise of temperature produced by lesions of the corpus striatum is due to an increased production of heat, and indeed the uniformity, the regularity, and the extent of the rise suggest this; it is interesting also to notice that the corpora striata first became well developed in warm blooded animals, but great stress must not be laid upon this as an argument until we are more sure of the precise homologues in the lower animals of the corpora striata in the upper. We are still more in the dark about the interpretation of the variations of temperature consequent upon lesions of the cortex. Considering their very irregular and rapid character, it is tempting to assume that certain parts of the cortex are concerned in maintaining the balance between the production of heat and its loss, but much evidence must be collected before anything certain can be said upon this difficult point.

A full account of these experiments will be published in the next number of the *Journal of Physiology*. I am much indebted to Mr. A. D. Fripp, Demonstrator of Anatomy at Guy's Hospital, and Mr. J. P. Pendlebury, my late house-physician, for helping me to take some of the temperatures.

GOULSTONIAN LECTURES ON LEAD POISONING IN ITS ACUTE AND CHRONIC MANIFESTATIONS.

Delivered at the Royal College of Physicians of London.

By THOMAS OLIVER, M.A., M.D., F.R.C.P.,

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LECTURE I.—(Continued).

Lead Poisoning from Hair Dyes; from False Teeth; from Adulterated Flour.—Colique Sèche of the Tropics.—Influence of Age on the Production of Plumbism.—Influence of Sex.

The use of hair dyes strongly impregnated with lead has been followed, not only by symptoms of saturnine poisoning, but by death. A ballet girl from the Tyne Theatre was admitted into the infirmary under my care suffering from colic headache and amaurosis; she had been using a cosmetic containing lead. She recovered.

A more striking illustration of the serious effects of the indiscriminate use of lead hair dye occurred in the practice of my friend, Mr. G. B. Morgan, of Sunderland.⁸ It was that of a maiden lady, aged 72, who sought advice because her left eye-

lid drooped, and that she could not raise it except with her fingers, that she saw objects double, and that for some weeks past both her arms ached continuously, and that the power in them was failing day by day. She also complained of loss of appetite and obstinate constipation. Her mind was perfectly clear; there was partial paralysis of both arms, ptosis, and divergent strabismus of the left eye. A week afterwards, when seen by Mr. Morgan, there was no improvement in the symptoms; and as the pains had not diminished, he ordered 7 grains of potassium iodide to be added to her mixture. Next morning she was found dead in bed. At the *post-mortem* examination Mr. Morgan naturally expected to find some lesion at the base of the brain. The most careful examination of the brain by himself and Dr. Ransom failed to reveal anything abnormal in the brain generally or in any part of it. The medulla, pons, and ventricles, and circle of Willis were all healthy. Thus was concluded a *post-mortem* examination which was to these gentlemen extremely unsatisfactory. At the necropsy, however, both were struck by the luxuriant black hair of such an old lady. One of this lady's nieces had been struck by the beauty of her aunt's hair during her lifetime, and she ventured the suggestion, Could her illness have been caused by the use of a hair dye, which the old lady made herself by mixing a packet of sugar of lead with sulphur in some liquid unknown to the niece? By its use, as Mr. Morgan suggested, may be explained the palsy of the upper limbs, and that of the third nerve, and then rapid death, following the administration of iodide of potassium on the theory of Melsens, that a soluble iodide had been formed which is highly injurious.

Dr. Macdowell, of the Northumberland County Asylum, informs me that twice he has seen patients who have worn false teeth made of cheap plates suffer from symptoms of lead poisoning. In both there was a well-marked blue line on the gums; each patient became insane. In one of Dr. Moxon's patients mania with hallucinations arose in a woman who for some inflammatory affection of the vagina had on her own account made use of a strong lead lotion.⁹

Flour is occasionally a medium through which lead poisoning is induced. In this country we see little of this, but in France there are periodic outbreaks of it.¹⁰ In one epidemic upwards of 100 people were suddenly attacked with violent symptoms, amongst which colic predominated. Nearly all those who suffered presented the characteristic blue line. The water supply was suspected, but could not be incriminated. On inquiry it was found that all the persons affected obtained their flour from the same mill, and that those who had partaken of rye bread suffered most. The tin buckets of the elevator which served to transport the rye flour from the grindstones had been tinned with lead, and these were found to have lost 150 grammes of their weight. Only the flour which passed through these buckets had caused symptoms of lead poisoning.

Dr. Marshall, of Pennsylvania,¹¹ reports that some time ago chromate of lead was used by the bakers of Philadelphia, and that in France, when eggs are scarce, it is employed to give a yellow tint to pastry. Dr. David Stewart analysed 64 cases of lead poisoning traceable to the consumption of cakes dyed with chromate of lead. In most of these cachexia, colic, arthralgia, blue line on gums were present, and traces of lead were found in the urine.

In Russia the use of tinned or canned meats has been followed by symptoms of lead poisoning, but on the authority of Professor Attfeld and Dr. Thomas Stevenson no acute cases of lead poisoning have occurred in this country from that source.

It is very rarely that lead has been given for a criminal purpose; generally it is taken by individuals, in France more than in England, with suicidal intent, or it is taken accidentally, as, for instance, where a person has drunk lead lotion in mistake for his medicine.

Trousseau¹² used injections of acetate of lead to the extent of from 460 to 900 grains in a litre without causing any symptoms. When lead has been prescribed internally it has been followed occasionally by symptoms such as those of gout, in

¹ Theory of Pyrexia, *International Journal of Medical Sciences*, November, 1890; and, On the Parallelism between the Three Thermic Mechanisms and Dr. Hughlings Jackson's Three Levels, *BRITISH MEDICAL JOURNAL*, April 26th, 1890, p. 949.

⁸ *Transactions of the Northumberland and Durham Medical Society*, April, 1887.

⁹ *Journal of Mental Science*, 1881, page 130.

¹⁰ *BRITISH MEDICAL JOURNAL*, 1887; Sajous, *Med. Ann.*, 1888-9.

¹¹ Sajous, *Med. Ann.*, 1888, p. 233.

¹² *Clinical Med.*, Trousseau, vol. iv, p. 81.

Dr. Lauder Brunton's case, or as in the case of Fouquier,¹³ who prescribed to a student of medicine suffering from phthisis pills composed of 1 grain of acetate of lead. The first pill caused slight colic, the second produced very sensible effects, but the third created such severe colic that it resulted in a magisterial inquiry. The apothecary who dispensed the prescription was accused of negligence, but on analysis only 1 grain of lead was found in each pill. Wherever, therefore, lead has been freely used, either in the manufacture of articles of food or as a conductor of drinking water, there has generally been a considerable risk of lead poisoning.

For several years now there has been known in the tropics a disease spoken of as the "dry belly-ache," or *colique sèche*—a disease which at times has played sad havoc with the sailors of the French navy cruising in the tropics. The West Indies and Guiana¹⁴ have been noted as the districts in which endemic colic has been most apt to occur. For a long period its causation was misunderstood, but there has been a gradual consensus of opinion in favour of the view that *colique sèche* or endemic colic is exactly the same as lead colic, and is traceable in every instance to the use of food or drink contaminated by the metal. The fact that the disease is almost entirely confined to the sailors of the French ships of war, and not in any corresponding degree to the inhabitants of the tropics, has given rise to considerable discussion and to not a little doubt as to the disease being saturnine. By many it has been regarded as a neurosis of the sympathetic, and due to chill; others have regarded it as of cryptogenetic origin, and others have claimed for it a miasmatic or malarial origin. Contradictory as all these opinions are, the view now generally adopted is that of Lefèvre, the Director of the Naval Sanitary Board at Brest, who says that "the *colique sèche* of the French navy is nothing more than lead colic." Many writers who had previously expressed contrary opinions have been gradually coming round to the view of Lefèvre, and the outcome of this expression of opinion from so high an authority as Lefèvre is already seen in the good results which have followed, for the Ministry of Marine are taking steps to render the disease less frequent in the French navy. When we know how very much more lead enters into the construction of French ships of war, no astonishment need be expressed at the greater frequency of colic amongst French sailors than those of other countries. Either as tanks for holding water or as pipes for conveying it, as plates for protecting the sides of the ship, in the form of putty and paint, or in the fact that the enamel of the drinking cups and cooking utensils on board a French man-of-war usually contain lead, this metal is more freely distributed throughout their ships than in those of other nations. The reason why English, American, and German sailors have not suffered in the same proportion is simply because that in their navies everything likely to give rise to lead poisoning has been carefully eliminated.

It is alleged by Dr. Stephen Mackenzie that, in the autumn, a larger number of lead cases is met with than at any other period of the year. On looking over the sick register at one of the lead factories, I find that in the months of June, July, and August, the largest number of "orders" are given to the hands to obtain medical relief.

How much of the prevalence of lead colic at one particular period of the year is accidental it is difficult to say. Trade may not always be so brisk at one time as another. Last year we had a strike amongst the lead workers which, beginning in May, ended in September. This fact renders the returns for the year unavailable for generalisation. Of the 1,217 cases observed by Des Planches, the largest number occurred in July. The warmest months of the year showed, according to him, the largest number of cases; and in these months Dr. Inglis, of Hebburn, noticed out of 947 cases of lead colic that there was a preponderance of cases. Inglis supposes that the lead dust is in the warmer months of the year more freely dispersed in the air. In this season vegetables play a larger part in the diet of the workers. Some have thought the winter months have furnished the largest number of cases, and regarded this as due to diminished elimination of the poison. In the early part of this winter I have seen more cases, but I attribute this to the fact that as it is known

amongst my *confrères* that I am on the outlook for lead cases a larger number has in consequence come under my observation. The season of the year, like climate, has in my opinion little to do with it, although Hirsch attributes the greater frequency of lead colic on board ships cruising in tropical waters, to the fact that the higher temperature there materially conduces to the development of lead poisoning, and that of all the men on board ship, those who are obliged to spend most of the day in an overheated and impure atmosphere suffer most, for example, the men employed in the kitchens and engine rooms.

As regards the age at which lead poisoning is most apt to occur an answer is with difficulty returned, owing to the fact that exposure to the poison is not equal at all ages. Children are not employed in lead factories, but it has been noticed that when an epidemic of plumbism occurs as the result of drinking contaminated water they suffer readily. The children of the "botanic beer" manufacturer whose case I quoted suffered, one died; but in the case of N., who died from drinking contaminated water, none of the children suffered, nor did they exhibit even the blue line on the gums. Taylor, in his work on poisons, alludes to the case of a child who died after taking for five weeks one-fifteenth of a grain of acetate of lead twice or thrice daily. There was colic, constipation, and fetid breath, then emaciation, and the limbs became paralysed, death occurring after convulsions and coma. In Keating's *Cyclopædia of Diseases of Children*, there is an excellent account of lead poisoning as it affects children. By the author of the article, Dr. Putnam, it is stated that if facts really point to a relatively slight liability on the part of children to poisoning from minute doses of lead, often repeated, it is a matter of interest as it indicates in all probability a more active power of elimination on their part. According to Des Planches, the largest number of cases occurs between the ages of 30 and 40, whilst in the epidemic at Bacup 15 to 50 is the period over which the liability to lead poisoning extended. Adults may be regarded as more predisposed to plumbism, for it is seldom met with in people after the age of 50, although I have met with it in men at 66.

Whatever doubt surrounds the question of age, there is, in my opinion, no doubt in regard to the very much greater susceptibility of the female to be contaminated with lead compared to the male; and this is not due simply to the fact of exposure in a lead factory to what may be regarded as the greater dangers, but depends upon sexual idiosyncrasy. This is an opinion so totally at variance with that given by several authors that I require to explain myself. My experience drawn from hundreds of cases is that, both as regards the acute and chronic forms of lead poisoning, women are much more quickly brought under its influence than men. The ratio of men to women employed in lead factories is in favour of the women, and at first sight it might appear as if the liability was explained by the greater number of women exposed. Taking a period of five years, I find that 135 cases of lead poisoning were admitted as in-patients at the Royal Infirmary, in Newcastle. Of these, 91 were women and 44 were men. Des Planches, on the other hand, regards women as less liable, even though employed at the same operations at a white lead manufactory as men, and so did Alderson. To me there is no comparison of the greater susceptibility of the female; and that it is not altogether a question of trade is shown by the fact that in the recent epidemic of lead poisoning in Yorkshire, where, out of 1,000 cases due to the drinking of water contaminated by the metal, the Special Correspondent of the BRITISH MEDICAL JOURNAL, 1890, vol. i, p. 974, found the proportion of females to males to be as 4 to 1. Against this may be urged the fact that women drink more water than men; but even allowing for this, the proportion would still be in favour of the female. Brown found 153 males as against 251 females. Not only is the female more susceptible, but she is so at an earlier age than the male, and is more likely to suffer severely, and from such nervous accidents as epilepsy. I find that the age at which the human female is most susceptible is from 18 to 23, and that in men from 41 to 48, and the interesting point in regard to exposure to lead is that, whilst young women suffer readily from saturnine poisoning, recovering quickly from colic, only to be more readily and severely affected on again exposing themselves, men may go on working for years—ten

¹³ René Moreau, *L'empoisonnement aigu par le Plomb*, p. 35.

¹⁴ Hirsch, *Geograph. and Historical Pathology*, vol. ii, p. 269 (New Sydenham).

Lead-poisoning cases admitted into the Royal Infirmary, Newcastle-on-Tyne, during five years ending June, 1889.

to twenty—having only one or two attacks of colic, and then after a very lengthened period of service may still fall victims either to lead paralysis or die from the effects of a kidney lesion due to the poison. It is difficult to say what length of exposure to lead is required to develop symptoms. In a fatal case of acute lead poisoning which I saw lately, the girl had only worked forty days in the factory altogether; these forty days were spread over nine weeks. The above chart shows the ages of lead workers admitted into the infirmary over a period of five years suffering from plumbism, and indicate the differences between the ages of males and females.

Not only is there a sexual, there is also an individual, idiosyncrasy to plumbism. There is a class of women too easily affected by lead,¹⁵ but what that type is it is impossible to say. Generally the class from which these people are taken are young girls who are practically without the comforts of a good home. Many of them lead a questionable life. They expose themselves to cold, and are frequently in a state of chronic starvation before going to the lead works, and are, therefore, in a fit state for rapidly breaking down under the influence of lead. Those who are careful in regard to personal cleanliness and are well cared for at home do not, as a rule, suffer. I have seen women in the lead works who have followed their occupation for twelve or twenty years, and who have seldom been away from work on more than two or three weeks, when they have suffered from constipation and colic. It is the ill-fed, the badly housed, and thinly clad young girl who suffers early. Women who are labouring to support idle or drunken husbands, or paramours, or women who have lost their husbands, and, having failed at other occupations, betake themselves to the lead factories tempted by the high wages, after a few months' or a few weeks' service, become the victims of plumbism.

Apart from the influence of external conditions, such as want of adequate food, and exposure, there is with this as with most other diseases not only an individual, but a family predisposition to lead poisoning. Whole families will suffer readily, others scarcely at all. This observation applies to both sexes. I have known a family in which four sons and the father, all strong and well-built men, smelters, died from the effects of lead poison, and I know of other cases where, probably as the result of heredity, the sons and grandsons of men who were house painters have become early and severely affected by lead, the hereditary taint markedly precipitating the attack.

Again, I repeat, female idiosyncrasy predominates. One of the first noticeable effects of the pernicious influence of lead is the production of anæmia or cachexia. Nearly all young women, those particularly between the ages of 18 to 24, when thus exposed suffer from deranged menstrual function; hæmaturia and ovarian activity are interfered with, and the result is either amenorrhœa or menorrhagia. Once the functional activity of the ovaries and blood making is interfered with, then is that woman already in a critical condition, and at any moment she may become the subject of any of those explosive outbursts of plumbism known by the name of lead encephalopathy. To sexual peculiarity I therefore attribute much of the danger from exposure to lead. Lead as a poison strikes early at the functions of blood making and reproduction, producing sterility, liability to abortion, and amenorrhœa or menorrhagia. Woman, from her constitutional idiosyncrasy, is, therefore, more liable to be impressed by lead. Whatever may be the power of sex, of family, and individual

predisposition; however potent may be the effects of inadequate food or clothing, if there is one agent which must greatly increase the influence of one or other of these as factors in determining lead poison, it is alcohol.

Once the individual has suffered from an attack of lead colic or any symptom of lead poisoning, he is launched upon a morbid stream of life where, under the influence of metabolism, which is making for health, he may safely steer his course and recover his health. On the other hand, if he is inattentive or unwilling to regulate the requirements of his constitution by abstinence from alcohol and again exposes himself, preferring thus to be wafted by the breeze that placed him on that stream, he floats the more rapidly down, heedless of the gulf in which he is so soon to be submerged. Between the first and subsequent attacks there are periods of quiescence; the first attack predisposes to the second, and this to a third; or a first attack is experienced, and without any fresh exposure, there is long after it another outburst. What is the meaning of this? Is it that during the period of apparent health lead has been deposited in some of the organs in an insoluble state, and that as the result of some particular diet, drink, or medicine, it has again been rendered soluble, circulates afresh in the system, and for the time being the person is poisoned with lead absorbed from his own tissues?

ABSTRACTS OF THE MILROY LECTURES ON DIPHTHERIA;

ITS NATURAL HISTORY, AND PREVENTION.

Delivered before the Royal College of Physicians of London.

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LECTURE IV.

MILK in connection with the causation and diffusion of diphtheria was next discussed, Dr. Michael Taylor's and Dr. Ballard's experiences being referred to as the first in which any such cause was suggested as having to do with the specific fevers. Mr. Power has the credit of having first definitely shown a relation between occurrences of diphtheria and the use of particular milk services, and his investigations as to this in North London, in 1878, were recorded in some detail, it being shown that the incidence of the disease on households taking the special milk, and those having another service, was at the rate of 60 and 5 per 1,000 respectively. And when the various circumstances by which milk could at that date be regarded as liable to become infective had been discussed, the suggestion had even then been made that there had probably been some contamination of the milk by particular cows suffering, whether recognised or not, from some specific disease. The idea as to the existence of some relation between disease in the cow and human throat disease was, indeed, not altogether new. There was the analogy of foot-and-mouth disease, and some early experiences of Dr. Thorne were referred to, in which he had found that young pigs fed on the milk of cows suffering from the latter disease were killed by it, whilst children using it suffered from certain affections of the mouth and fauces. Other diphtheria outbreaks, having somewhat similar histories, were quoted,

¹⁵ T. Oliver, Local Industries, British Association Meeting, 1889.