This tenderness, I may say, I have found present in several patients suffering from plumbism, though I would not like to go so far as to say that this form of sciatica is pathognomonic of plumbic poisoning.

The next time I saw him was on February 14th, 1910, when in addition to the above signs I found both wrists somewhat weak and suggestive of plumbism. With the permission of his medical attendant I prescribed calcium permanganate, $\frac{1}{2}$ grain, three times a day; after fourteen days I found that the lead line had disappeared, as well as the sciatic tenderness, while the wrists were decidedly stronger.

CASE II.

C. F., aged 54, a mason, constantly employed at lead works, especially for repairing the culverts along which the fumes travel, fractured his clavicle, but this by December 13th, 1909, when I saw him for the first time, had healed well. He had a lead line and was very anaemic, but there was no other sign or symptom of plumbism present. I ordered calcium permanganate, $\frac{1}{2}$ grain, mixed with paraffin, and put up in the form of capsules by Messrs. Allen and Hanbury. This method of administration does away with the disagreeable taste of the drug, and it also allows its action to be gradual.

At the end of three weeks the lead line had disappeared and this appearance had distinctly improved, the anaemia having nearly disappeared.

CASE III.

J. P., aged 35, who had been fifteen years at the lead works, was very pale and both wrists were rather suggestive of plumbic weakness. There was a lead line on the gums and also a dark deposit on the mucous membrane of the lower lip.

After three weeks' treatment with the drug (in capsules) the lead line disappeared, and there was a considerable diminution of the dark deposit on the mucous membrane. The pallor, which at first was marked, became gradually less, and eventually he developed quite a healthy appearance, while the wrist weakness also disappeared. He observed that the drug had the effect of causing his bowels to act three times a day, instead of twice. All the deposit disappeared by the end of five weeks.

CASE IV.

F. S., aged 31, whom I saw on June 9th, 1909, had to give up work on account of "wrenched back." There was tenderness over the lower third of the sciatic nerves; he also had a lead line, as well as a line of black tartar. After taking calcium permanganate for fourteen days, the lead line disappeared, leaving the black tartar line, which only required the use of a toothbrush.

CASE V.

J. W., aged 40, was pale, and the wrists suggested plumbism. The saliva gave a very slight reaction in the test for potassium sulphocyanide.

After three weeks' treatment the lead line was very much less, the wrists better, and the potassium sulphocyanide reaction much more satisfactory. The man's alcoholic habits considerably interfered with the treatment in this case.

Several other cases have responded to the treatment in such a satisfactory manner as to emphasize the value of calcium permanganate in the treatment of cases of plumbism.

The drug should in all cases be given in capsular or palatinoid form, as otherwise it has a tendency to nauseate the patient, and terminate the treatment somewhat abruptly.

On reflection the good result is not surprising, for the drug has been found, not only by myself but also by many other medical men, to be of great value in inflammatory states of the alimentary canal, and my original observation that the lead line is superimposed on a red line is, I venture to think, corroborated by the result of this treatment.

In addition I would draw attention to the fact that the alcoholic habits of the men employed at lead works, together with the usually foul state of the mouths and teeth, are more than likely to result in an inflammatory state of the stomach, on to which inflamed area the lead, as in the case of the gums, is more than likely to find its way and settle.

Calcium permanganate being of value in gastritis acts therefore in the nature of a preventive, and if my results are corroborated it is worth while considering whether it will not be advisable in the future to order the periodic administration of this drug to all the men at the works.

THE French Chamber of Deputies has passed a law giving communes, or portions or groups of communes within whose area there may be mineral springs, power to constitute themselves, after permission obtained from the Government, hydromineral or climatic stations. For the maintenance and development of these stations the communes may be empowered to levy special rates during a season or the whole year. On these rates they may be authorized to raise loans for the purposes indicated.

THE CAUSES OF ABSORPTION OF OXYGEN BY THE LUNGS.

BY

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(PRELIMINARY COMMUNICATION)*

It has for long been a subject of controversy among physiologists whether the absorption of oxygen through the walls of the lung alveoli into the blood occurs simply by diffusion or by an active physiological process analogous to glandular secretion.¹ Pflüger, Fredericq, and, quite recently, Krogh,² have brought forward experimental evidence in favour of the diffusion theory, while Bohr, and Haldane and Lorrain Smith have supported the secretory theory, which was originally suggested by Ludwig.

If the partial pressure of oxygen is ever greater in the arterial blood leaving the lungs than in the air of the lung alveoli, it is clear that the simple diffusion theory must fall to the ground; and the experiments hitherto made have been designed to ascertain whether or not the oxygen pressure in the arterial blood is ever greater than in the alveolar air. Bohr, Fredericq, and Krogh have with this object employed improved forms of Pflüger's well-known "aerotonometer," the instrument finally devised by Krogh being very perfect of its kind. Haldane and Lorrain Smith's method depends upon the following facts: When blood is brought into prolonged and intimate contact with a mixture of carbon monoxide and air the haemoglobin of the blood corpuscles combines partly with the oxygen and partly with the carbon monoxide, the final proportions (which can be easily and accurately determined) depending, in accordance with the laws of mass action, on the relative partial pressures of the oxygen and carbon monoxide, and on a constant. Hence, if the final proportions, the constant, and the partial pressure of the carbon monoxide are known, the partial pressure of the oxygen can be accurately deduced. By supplying to an animal air containing a fixed proportion of carbon monoxide, until the final saturation of its haemoglobin with carbon monoxide is reached, the partial pressure of oxygen in its arterial blood can be calculated on the same principle. If the arterial oxygen pressure is greater than that of the alveolar air, the final saturation of the haemoglobin with carbon monoxide will be less than that of blood saturated with the same air outside the body and vice versa. It is, of course, assumed that carbon monoxide diffuses freely through the body, since, apart from its property of combining with the haemoglobin, it is, as was experimentally shown by Haldane, a physiologically indifferent gas, like nitrogen or hydrogen.

Haldane and Lorrain Smith determined the constants required in their calculations, not from experiments at body temperature on blood from the animals experimented on, but on dilute blood solutions or undiluted human blood. This omission, which in the then existing state of knowledge did not seem important, has, we find, seriously affected their estimates of the oxygen pressure in the arterial blood. The constant varies distinctly for the blood of different animals, and even for different individuals of the same species. We have therefore repeated the experiments, using mice, on which most of Haldane and Lorrain Smith's experiments were made, and determining the constant for the blood of each animal experimented on. We find that in general their estimates of oxygen tension were about a third too high. We have also supplied an omission in their experiments by investigating the arterial oxygen pressure in animals breathing a very low percentage of carbon monoxide (less than 0.02 per cent.), so that no physiological disturbance is produced by the gas.

Our results with mice are as follows:

1. When a very low percentage of carbon monoxide is breathed, so that no want of oxygen is produced in the body, the arterial oxygen pressure is slightly below the alveolar oxygen pressure. Apparently, therefore, the absorption of oxygen is by diffusion alone, as indicated by the experiments of Fredericq and Krogh and by most of Bohr's experiments.

* Communicated to the Royal Society, March, 1910.

The results agree closely with Bohr's recent calculations of the arterial oxygen pressure which might be expected during rest if diffusion alone were in play.

2. When a much higher percentage of CO is breathed (0.2 per cent. or more) the oxygen pressure in the arterial blood rises to nearly double that of the alveolar air, and considerably above that of the external air. With intermediate percentages of CO there are intermediate rises in the arterial oxygen pressure.

It is thus evident that, although under normal resting conditions absorption of oxygen occurs only by diffusion, want of oxygen in the tissues of the body brings into play a supplementary secretory activity by which oxygen is actively absorbed from the alveolar air into the blood. This process is presumably analogous to that by which oxygen at a partial pressure of sometimes as much as 100 atmospheres above that in the sea water is secreted into the swim-bladder of deep-sea fishes.

It is satisfactory to find that the results by the carbon monoxide method agree closely with those hitherto obtained by the aerotonometer method. The reasons why Fredericq and Krogh have obtained no evidence in favour of the secretion theory are also evident. Still more satisfactory is it to find that the process of absorption of oxygen by the lungs is regulated, just as is the breathing itself, in accordance with the physiological requirements of the organism. But for the secretory process the blood would be very incompletely saturated during muscular work, when five, or even ten, times as much oxygen is absorbed as during rest. During rest, on the other hand, the secretory process is not required, and would be a waste of physiological effort.

REFERENCES.

¹A comprehensive account of this controversy is given by Bohr in Nagel's *Handbuch der Physiologie*, vol. i, p. 142, 1905. ²Skand, *Archiv für Physiologie*, vol. xxiii, pp. 179-278, 1910.

AUSCULTATORY FRICTION:

A LITTLE-USED METHOD OF PHYSICAL EXAMINATION.

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OLD students at University College Hospital will well remember the four methods of physical examination: "First, inspection; secondly, palpation; thirdly, percussion; fourthly, auscultation." To this a fifth should be added, which, for want of a better term, may be called "auscultatory friction" or "auscultatory percussion."

It is a common practice with physicians to make use of a method of auscultatory percussion in mapping out the stomach. By placing the stethoscope over the stomach and tapping lightly with the finger a hollow sound is conducted to the ear as long as the percussing finger and the stethoscope are over the area where the stomach is in contact with the body wall. If the stethoscope is shifted away from this area, the sound becomes notably diminished in intensity, and the same thing occurs if the stethoscope remains in contact with the stomach area and the percussing finger moves off it. In this way it is possible to map out with considerable accuracy the area of a hollow viscus, such as the stomach.

But it is especially in dealing with solid organs that auscultatory friction is so valuable. Information may be obtained in this way which no other method of physical examination can elicit. So far as I know, it is not taught in the medical schools, and is not practised by the generality of practitioners.

By percussion it is only possible to define the outlines of a solid or fluid in contact with a viscus containing air, but by auscultatory friction it is perfectly easy to determine the outline of a solid organ in contact with another solid or with fluid.

For instance, in percussing the heart, the lower margin where it rests over the liver cannot be defined, but auscultatory friction readily shows this. Also to mark out the spleen when there is a pleural effusion on the left side is impossible by percussion alone, and can only be done by the combined method. Again, a pleural effusion of limited extent on the diaphragmatic surface of the right lung is easily overlooked if percussion alone is relied upon; the dullness of the liver is continuous with the dullness of the fluid, and one cannot tell where one begins

and the other ends, but by auscultatory friction a sharp line of demarcation between the liver and the fluid is readily obtained.

It is obvious that it is important to practise a simple and easy method by which such information is available.

Some five or six years ago I found that by placing the chest-piece of a binaural stethoscope or phonendoscope over the liver or the heart, and gently rubbing the skin in the neighbourhood with the tip of the finger, a loud sound was conveyed to the ear as long as the finger was over the solid organ; as soon as it passed off the area which covered the organ the sound became almost inaudible, the solid organ under the abdominal wall acting as a stethoscope in conveying the sound to the ear. If the stethoscope is placed over the liver, and gentle friction made with the tip of the thumb, the upper limit of the organ can be defined with the greatest accuracy, even when a layer of fluid is above it, or another solid organ, such as the heart. If the stethoscope is placed over fluid, such as a pleural effusion, the sound becomes lost when the finger passes over a solid or air-containing organ.

I thought at the time I had made an important discovery, but I have since found that the method had already been described and practised. Sir Lauder Brunton tells me that he has made use of it for at least ten years, but agrees with me that it deserves wider recognition.

Memoranda:

MEDICAL, SURGICAL, OBSTETRICAL.

TREATMENT OF TUBERCULOUS MENINGITIS.

IN his most interesting lecture on Meningitis in Children, Dr. Guthrie Rankin, in speaking of the tuberculous form, says, "Cases of recovery are so rare that many observers believe the disease to be invariably fatal."

Many years ago I was asked to see a little boy in the second week of tuberculous meningitis. As he was extremely emaciated and profoundly anaemic, a mixture containing potassium chlorate, tincture of ferric chloride, and glycerine was prescribed. The chlorate was given in the somewhat empirical hope that it might somehow yield oxygen to the tissues. The mixture was steadily continued for three or four weeks. An improvement was almost immediately evident, and the child eventually made a good recovery, although his head remained slightly but distinctly enlarged. I have always felt convinced that the boy owed his recovery to the potassium chlorate. I have never since had an opportunity of trying it in tuberculous meningitis, and I only venture to mention the case now in the hope that some one else may be induced to give this mixture a further trial.

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HAEMOPHILIA IN A FEMALE.

THIS condition is, I think, sufficiently uncommon to be recorded. I merely give the history of the child itself; I could obtain no family history of haemorrhages (except from the lungs in members of the parents' families known to be phthisical) on going back two generations beyond the parents.

Born December, 1907. At birth brown patch over left eye, which cleared up in a few days, showing disease, probably congenital. Mother often noticed that the child easily bruised on falling.

December, 1908. Sharp attack of bronchitis with melaena, much blood being lost.

Spring, 1909. Severe haemorrhage lasting three to four days from mere scratch on finger.

April 9th and 16th, 1910. Bleedings from mouth, on both occasions stopping spontaneously.

April 18th. Further attack of bleeding from two points in mouth, death ensuing.

Child well nourished, had had a liberal and varied diet. No history of swollen joints, or suggesting purpura; no signs of scurvy. One brother, showing no disposition to haemorrhages.

Reading.

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