determination of δ . Thus a specimen which has a true freezing point, -0.61°C ., indicating an advanced state of disease, may appear to have a value $\delta = 0.58^\circ \text{C}$., a normal value, if the zero has shifted 0.03°C ., a by no means unlikely amount in warm weather.

SUPPURATIVE APPENDICITIS IN A PATIENT WITH TRANSPOSED VISCERA.

By HAROLD HEBBLETHWAITE, M.R.C.S. ENG.,
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INSTANCES of transposition of the viscera are sufficiently rare to be of interest, and the following notes on a case of appendicitis in the left side are worthy of record on account of the rarity of the condition and the lack of symptoms pointing to the severity of the disease.

A tall, thin, fair-complexioned boy, aged 16. With the exception of mild attacks of the usual exanthemata had never had any illness worthy of mention, and to the day prior to my seeing him had been at school, apparently in good health.

On physical examination it was at once seen that the position of the internal organs was abnormal. The heart apex was felt in the fifth intercostal space, $1\frac{1}{2}$ in. to the right of the sternum, and the heart dullness was all on the right side. The

Transposition of viscera (Kelly's vermiform appendix).
a, Heart; b, liver; c, stomach; d, gall bladder; e, transverse colon; f, descending colon; g, caecum; h, vermiform appendix; i, rectum; j, bladder.

Liver could be palpated on the left, and the resonance of the stomach elicited on the opposite side. The heart sounds corresponded to the unusual position, the second sound being loudest in the second left interspace.

On May 17th, 1906, he returned from school complaining of sickness and pain in the abdomen. On examination the following day the abdomen was tense but not very tender; the bowels were constipated and he had vomited a portion of his breakfast; the temperature was 100.5° and the pulse 70. He said that he did not feel very ill, nor did his looks indicate any severe condition. In twenty-four hours, however, the pain returned and the abdomen was distended. Both flanks were very painful on pressure but distinctly more on the left side. The probable transposition of the appendix into the left iliac fossa led me to suspect that organ to be the cause of the trouble. Mr. Moynihan, of Leeds, in consultation, agreed with this opinion, and we treated the case on expectant lines with a view to an operation when the acute symptoms passed off. For the first forty-eight hours the patient was not allowed any food, and for some days after only egg albumen solution and very light food, the bowels being acted upon by glycerine or simple enemata. During the next fortnight the symptoms somewhat abated, and occasional pain on the right side, as of peritonitis, was relieved by turpentine stupes; the general malaise did not quite subside; there was occasional vomiting; the temperature was subnormal and the pulse 60 to 70. Deep-seated pain was produced by pressure on the left iliac region, and there was a want of resonance on percussion.

An operation was performed by Mr. Moynihan on June 12th, ether being the anaesthetic. A preliminary incision 5 in.

long in the central line, to locate the appendix definitely, revealed an unexpected condition. The whole peritoneum showed signs of old peritonitis; the intestinal coils were adherent, and numerous bands were felt. These were broken as much as possible before closing the wound. The abdominal viscera were found to be transposed. A second incision extending from a point 3 in. to the left of the umbilicus downwards and inwards for a distance of 7 in. to the central line was then made. On opening the peritoneum it was found that the left iliac region was occupied by an abscess containing foul pus; the appendix was in a gangrenous state, and a perforation of the caecum communicated with the abscess. A counter opening was made in the loin, two large drainage tubes were inserted in the wounds, and the cavity left to drain.

The patient rapidly recovered from the shock of the operation. The temperature, which had been subnormal for nearly three weeks, rose to 100.5° on that evening. It kept afterwards about 99° , and slowly sank to normal.

The abscess cavity was irrigated twice daily with sterilized water and peroxide of hydrogen. Faecal matter appeared in the dressings until the end of July, and the sinus finally healed in the last week of August.

Points of interest in the case are: First, the very slight inflammatory symptoms preceding so large a collection of pus; secondly, the absence of any history of previous illness to account for the extensive adhesions over the whole peritoneum, and the rapid and complete healing of the perforation from the sloughing appendix.

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British Medical Association.

REPORT CIII.

THE HALDANE-SMITH METHOD OF ESTIMATING THE OXYGEN TENSION OF ARTERIAL BLOOD.

By W. A. OSBORNE.

(From the Physiological Laboratory, University of Melbourne.)

[ABSTRACT.]

THE theory of the method depends upon the fact that both oxygen and carbon monoxide form dissociable compounds with haemoglobin. If haemoglobin be subjected to a mixture of both O_2 and CO , the haemoglobin will be distributed according to a law which may be expressed in the form of an equation:

$$\frac{p_{\text{CO}}}{p_{\text{O}_2}} = K \frac{C_{\text{COHb}}}{C_{\text{O}_2\text{Hb}}}$$

where p_{CO} and p_{O_2} are the pressures of carbon monoxide and oxygen respectively, C_{COHb} and $C_{\text{O}_2\text{Hb}}$ the concentrations of carboxyhaemoglobin and oxyhaemoglobin respectively, and K a constant.

If the amount of haemoglobin unattached to either O_2 or CO be negligibly small, as it is in the experiments in question, we may write this equation as follows:

$$\frac{p_{\text{CO}}}{p_{\text{O}_2}} = K \cdot \frac{a}{100 - a}$$

where a is the percentage saturation of the haemoglobin with CO . In the experiments of Haldane and Smith an animal breathed a definite percentage of CO in air giving therefore p_{CO} . The percentage saturation of the blood was determined by a colorimetric method. The constant K can be calculated if we know the curve of dissociation of carboxyhaemoglobin in the presence of a fixed pressure of oxygen. In these experiments of Haldane and Smith the blood of the animal was found to contain less carboxyhaemoglobin than if the blood was shaken *in vitro* with the same gas mixture. If the experiments were correct, and no purely physical explanation of the fact forthcoming, and if it be granted that the lung does not do work by keeping CO out, then we must assume that the lung does work by forcing oxygen into the blood against pressure. From these experiments of Haldane and Smith calculated that the arterial blood of man contained oxygen at a pressure of 38.5 per cent. of an atmosphere.

In criticizing these researches it can be shown:

1. That the colorimetric method cannot give reliable results, as it violates two fundamental laws of colorimetry.

The two fields of colour are given by cylindrical lenses, which are some distance apart instead of being uniform, and separated by a theoretical partition. Moreover, it has been shown that variations in the quality of the light during the colour comparisons do not affect the two readings *pari passu*, so that varying values may be found for a blood partially saturated with CO and of constant composition.

The curve of dissociation of carboxyhaemoglobin in presence of air determined by the colorimetric method is a rectangular hyperbola giving a value to $K = 0.0032$. But Hüfner, by means of his spectrophotometer, obtained a different curve, which is also hyperbolic and giving a value to $K = 0.0064$, or double that obtainable from Haldane and Smith's curve.

2. That no account has been taken in Haldane and Smith's calculations of the action of the counter diffusion of gases which was first demonstrated by Wretschko in 1870. A repetition of Wretschko's experiments was made in which CO₂ and O₂, each containing the same percentage of CO, were allowed to diffuse into each other in a closed system which ensured that the quantities of CO₂ and O₂ diffusing in unit time would be approximately equal. It was found, in accordance with Wretschko's experiments, that the CO₂ during the diffusion heaped up the CO in the direction of its diffusion. One can, therefore, state that in the lung the outward drift of CO₂ hinders the absorption of CO more than the inward drift of oxygen helps the absorption of CO.

The conclusion arrived at is, therefore, that Haldane and Smith were not justified in concluding from their experiments that the lung was a secreting organ doing work by forcing oxygen inwards, and in consequence raising the tension of the oxygen in the arterial blood above that in the alveolar air.

A criticism is also given of Haldane's later form of gas analysis apparatus, and some possible sources of error described.

Towards the expenses of this research a grant has been made by the British Medical Association, on the recommendation of the Science Committee of the Association.

REPORT CIV.

A CLINICAL METHOD FOR ESTIMATING THE COAGULATION TIME OF THE BLOOD.

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ERNEST HART RESEARCH SCHOLAR.

(From the Laboratory of the Royal College of Physicians, Edinburgh.)

In applying the method to be described the following apparatus are required:

Capillary glass tubes of certain dimensions.

A pricker.

A file or glass knife.

A flame for fusing the capillary tube.

A thermometer.

In case of accurate scientific determination, a chamber regulated to the temperature required for the observation.

The bore of the capillary tubes is 1.5 mm., is uniform throughout, and the length of the tubes is about 6 in. The tubes are blown by a skilled glass-blower to as near the above dimensions as possible, and cost 2s. per 100. The other requisites require no explanation.

To Test the Coagulation-rate.

The hands are thoroughly washed with soap and water, and then held below the tap to wash off the last traces of soap. They are then dried on a clean towel. The minute from which the coagulation time is to date is then noted down, as well as the temperature of the room. With the watch marking seconds close at hand, the observer waits till the seconds hand is about ten seconds from the minute noted down. A rag is then bound tightly round the finger, and when the seconds hand reaches the exact minute, the finger is given a good sharp stab with the pricker. The capillary tube is then seized and applied to the drop, inclining it or keeping it horizontal according to the flow of blood, thus maintaining a continuous column in the capillary tube. About 4 in. of the tube can easily be filled in 10 seconds from the moment of pricking. The column of blood is then allowed to run down the tube to such a distance that it will not be injured by applying heat to the end into which the blood was received. This

end is then fused (alternatively it may be closed with sealing wax or paraffin). The fusion keeps the column of blood steady, and care must be taken not to seize the tube between the sealed end and the end of the column of blood nearest it, otherwise the expansion of the air causes a movement of the column. The tube is then laid down with the thermometer beside it, and at the end of each minute a file mark is made on the capillary tube $\frac{1}{2}$ in. or less from that end of the column of blood remote from the sealed end of the tube. This piece of the tube is then broken off, care being taken in breaking it to keep the two ends of the glass approximated. The two ends of the glass are then drawn apart, and the first stage of coagulation visible to the naked eye is shown by a minute thread of fibrin stretching between the two broken ends. When this is reached the other parts of the tube are similarly broken to confirm the first observation. A further confirmation can be got by holding up the capillary tube to the light and noticing that when coagulation has reached the stage of the formation of the thread, the column of blood in the tube, instead of having the regular contour it had before, has a ragged, irregular, whitish outline.

Points to be noted are that the hands must be clean and free from soap. The pricker must be cleaned after each prick with clean water; the finger must be similarly treated, and blood must not be drawn twice from the same prick. These latter precautions are necessary to avoid sucking up formed fibrin ferment into the tube with the blood and thus increasing the coagulation-rate. The only other point is with regard to the breaking of the tube. The tube must be broken and yet the ends kept together, otherwise the fibrin thread may be broken. One can suspect that this has happened by the blood column bulging out at the broken ends, as contrasted with the almost concave appearance one gets when the blood is fluid. If the thread has been broken, another piece should immediately be broken from the tube, a proceeding also undertaken, as noted above, for corroboration when the fibrin thread has been got.

I have done a good number of series of consecutive coagulation tests on myself. These were done in the evening. The time for the first appearance of the fibrin thread in all of them ranged from 7 to 9 minutes, the bulk of the readings being at 8 minutes. Of these series I shall give one, consisting of 8 consecutive readings done in my rooms from 8.3 p.m. to 9.18 p.m. (1½ hours):

My finger and the pricker were washed in a tumbler of water and dried on a clean rag, and the capillary tube was fused in an ordinary fish-tail burner. The temperature of the room ranged from 16.5° C. at the beginning to 17.5° C. at the end of the observations. Coagulation times in this series: First = 7 minutes; second = 8 minutes; third = 7 minutes; fourth = 9 minutes; fifth = 8 minutes; sixth = 8 minutes; seventh = 8 minutes; eighth = 8 minutes. Four other normal individuals gave at the same time the following readings: No. 1 = 6 minutes; 2 and 3 = 7 minutes; 4 = 8 minutes (twice).

I next give readings taken in the morning (9 a.m. to 11 a.m.) of 5 normal individuals with myself as control. The temperature of the room was 15° C.:

A = 10 minutes; B = 9 minutes; C = 11 minutes; D = 11 minutes; E = 11 minutes; myself = 11 minutes.

It will be seen that the coagulation-rate is much slower in the morning than in the evening, and Bürker, confirmed by Buckmaster, states that according to the time of day, amount of exercise, or kind of food, the coagulation-rate may be as low as 5 minutes or as high as 14.5.

The object of this note has been to demonstrate the possibilities of this method for clinical purposes. For clinical purposes, the providing of an apparatus for keeping the blood at a uniform temperature seems to be superfluous, as from all my readings done at room temperature, which varied from 15° C. to 20° C., there was no change in the coagulation-rate corresponding to elevation or lowering of temperature within these limits. This might be expected, considering that the blood is drawn at 37° C., that glass is a non-conductor of heat, and that the coagulation time is so short. It might be a factor to be considered in the case of bloods of long clotting time. In such cases a control with the observer's blood could be done and the result expressed as an index. This control would also correct any error from differences in roughness of the inner surface of the glass tubes in different samples of glass.

This method can also be used for the determination of