was anxious; pulse 116; and tongue furred. A little bile had been vomited. One-sixth of a grain of hydrochlorate of morphia was given every four hours.

7 P.M. He had vomited a great quantity of greenish fluid; and lay with his knees drawn up, suffering much pain. The abdomen was very resonant and tender.

Dec. 14th. His expression was haggard; pulse very feeble and irregular. He had great thirst, and constant vomiting of green fluid, amounting to four pints in the twenty-four hours; no action of the bowels; abdomen very resonant; respiration entirely thoracic. He had passed a restless night. A pill, containing a grain of calomel and one-sixth of a grain of morphia, was given every four hours.

Dec. 15th. The vomiting and constipation continued. The abdomen was less resonant at the upper part, and quite dull, with distinct fluctuation below the umbilicus. He was ordered to have an enema of beef-tea, with half a drachm of tincture of opium.

Dec. 16th. He was somewhat improved; pulse 112, and of fair volume; tongue cleaning. He was still vomiting large quantities of fluid, which was now of a yellow tint. There was no action of the bowels; the injections of beef-tea had been retained. The abdomen was less tender, resonant on the left side, dull on the right, and fluctuating in the right iliac region. The enema was repeated.

Dec. 18th. He was much emaciated, and his eyes sunken. The vomiting and constipation continued, Percussion of the abdomen yielded the same results. A blister was applied to the epigastrium; and he was ordered to take every three hours an effervescing soda draught, with one minim of hydrocyanic acid (Scheele's).

Dec. 20th. The abdomen was now resonant all over. There was still the same vomiting and constipation; and two large injections, containing castor-oil, had been retained. Pulse 100, very feeble. At night, a profuse sweating came on; and he died at nine the next morning.

AUTOPSY. There was much general peritonitis, the intestines being glued together with recent lymph. The ascending colon was pushed over towards the left side; and occupying its place was a cyst containing fluid, which would hold about three pints, extending as high as the under surface of the liver (which was much displaced upwards), and backwards to the psoas muscles, in which it lay. It consisted of the kidney, or its pelvis, enormously distended, and filled with pus; all trace of kidney-structure having disappeared, except one small portion and three much dilated calices. It was every where adherent by lymph; and, in separating it from the liver, an escape of pus took place through a rent in the sac. The liver itself was healthy. The left kidney was of three times the natural size, but sound in structure.

THE LANCET AND THE AMERICANS. The *London Lancet*, in a notice of the defence of the late Surgeon-General of the United States Armies, makes it the occasion of very undignified and uncalled for vituperative and sneering remarks about the Government and people of the United States. As ardent as is the hatred of a majority of certain classes of the English of our country and its institutions, we think that a medical journal is scarcely the place in which to make exhibition of it. That surely is not the legitimate work of a medical journal. (*Philadelphia Med. and Surg. Reporter.*)

Original Communications.

ON THE PHYSICS OF DISEASE,

AND THE PHYSICAL PATHOLOGY OF THE BLOOD.

By BENJAMIN W. RICHARDSON, M.A., M.D., Senior Physician to the Royal Infirmary for Diseases of the Chest.

CHAPTER III. (*continued from p. 167.*)

The Oxidation of Blood. Effects of Ozonised Air.

IN the first part of this chapter, published in the JOURNAL of Feb. 18th, I demonstrated the influence of active or ozonised pure oxygen. I proceed now to show the effects produced by the respiration of ozonised atmospheric air. In this series of inquiries, the chamber delineated at page 84 was employed, and the air was ozonised by means of Siemen's instrument, also described on page 84 of the JOURNAL. In all cases, the animals were well fed previously to the inhalation, and the air introduced was at first feebly ozonised; moreover, they were placed in the chamber for some little time before the ozone was driven into it, in order that every sign of excitement might subside. Lastly, in the experiments, the temperature of the air was sustained at 60° Fahr., and was allowed to rise above that degree according as was desired. It is important to remember, in respect to the influence of temperature in experiments with ozonised air, that marked physiological effects are not elicited at a temperature below 60°. At 50°, the influence is almost *nil*.

Inhalation of Air Saturated with Ozone. Synthesis of Congestive Bronchitis.

Air ozonised to the fullest possible degree, and at a mean temperature of 63° Fahr., was passed through a chamber containing a guinea-pig and a rabbit. Both animals were in good condition; the rabbit had been fed mainly on green vegetables and bran, the guinea-pig on bread and milk with a little vegetable. The current of air, passing from the ozone-tube to the chamber, was very brisk, and the escape from the chamber was most free; so that there was no possibility of accumulation of carbonic acid. I myself inhaled the air issuing from the escape-tube of the chamber several times; it was always powerfully strong of ozone, and irritating to the nostrils and throat. After inhaling it for a time, it conveyed the idea of being heavy to breathe, and it produced some headache, which quickly passed away.

In a few seconds after the commencement of the inhalation, the animals began to show signs of irritation. The breathing soon afterwards was quick, laborious, and deep. At the end of an hour, the guinea-pig was breathing four to one, as compared with the rabbit. At the close of an hour and a quarter, the rabbit was breathing hoarsely, with the head thrown back and without movement as though it were comatose; the guinea-pig showed no sign of coma, but was breathing at the rate of 120 per minute.

The inhalation was continued for two hours, when the animals were removed from the chamber. The chest of each was now carefully examined with the stethoscope. Both animals were breathing quickly,

and in both there was the hoarse, dry, cooing murmur of respiration, which is so definitely characteristic of the first stage of bronchitis. The heart-beat was quick and embarrassed, and the skin was hot and dry. The guinea-pig was in every sense the most affected. After ten minutes, both animals were placed in their ordinary hutch. Very soon afterwards, the guinea-pig began to sink, and died. The rabbit continued to breathe quickly, and for some hours was indifferent to food and feverish. The mucous membrane of the nose and mouth was also dry and injected. On the following day, the respiration was still quickened; but the dryness of respiration had given place to a moist *râle*. On the third day, the animal may be considered as having recovered.

Immediately after death had taken place, the body of the guinea-pig was quickly opened. The right side of the heart was found congested with blood; and the kidneys and all the vascular organs were greatly congested. The lungs were ecchymosed; in parts, their structure was as white as milk; in other parts, there were deep congested spots of the size of a pea, into which blood was effused. The bronchial surface was not congested; but was covered with a frothy tenacious mucus, which exuded from the lungs in all parts where they were incised. The blood underwent moderately quick coagulation, but its colour was not materially modified; the venous blood was, perhaps, more than usually dark; and the arterial, by contrast, was markedly red. These were the natural conditions of the blood of the animal, in a degree peculiarly well developed.

In this experiment, we gather very important and useful information. We see, in a word, an induced bronchitis—a true synthesis of disease. If a man had been exposed out of doors to ozonised air, and had returned home with similar symptoms of disease, quick pulse, hot skin, rapid breathing, and dry coarse respiratory murmur, we should not hesitate for a moment in our diagnosis. If he died rapidly, and we found the morbid conditions presented by the guinea-pig, we should undoubtedly return the disorder that killed as congestive bronchitis. If he recovered with free secretion on the bronchial surface, as the rabbit did, we should style the affection acute bronchitis terminating by resolution. It does not seem to me that the formulæ of the artificial and of the natural disease admit of distinction or difference.

It is worthy of note that, in the experiment thus recited, the air was saturated with ozone. It may be asked on this, whether the same train of symptoms would follow if less activity of oxygen had been produced. I have an answer to that inquiry at hand. Fourteen days previously to the performance of the last experiment, the very same animals were exposed to a current of ozonised air for the same period of time. On that occasion, the air was ozonised to not quite half the same degree as before, and the temperature of the air was five degrees lower. Then both animals manifested symptoms of the same character precisely as on the later occasion; but the symptoms were not so intense. Both animals had rapid breathing, hurried circulation, and coarse respiratory murmur; but on being removed from the active air, they recovered without a bad sign.

Lastly, the rabbit had, with another rabbit, been made to breathe air partly charged with ozone at a temperature of 56° Fahr., one month previously to the second experiment. It and its fellow then exhibited similar symptoms; but, after two hours' inhalation, it recovered on removal into the open air. I was aided in all these inquiries by my friend Dr. Wood; and no element, as far as we could see, was wanting to make the research complete and free from objection. The apparatus was most simple, the working easy, and the proceedings of each successive step were conducted carefully and without haste. The same care was taken in the experiments related in my previous paper, where oxygen itself was employed.

Taking the whole series of experiments into consideration, I do not think there can be a doubt that ozonised oxygen, on being inhaled, produces, as its first degree of action, catarrhal irritation of the mucous membrane of the mouth, throat, and nostrils; as its second degree, extension of irritation to the bronchial surface, and bronchitis; and, as its third, exudation into the structure of the lung, molecular change in the blood, with separation of fibrine, a form of general inflammatory fever and death.

And now the great and vital question to be considered is:—Whether we, as occupants of this earth and enclosed in a vast chamber of atmospheric air, are ever exposed to oxygen in such active condition that it shall light up in us the same symptoms as can be artificially induced in the inferior animals. The question would seem to admit of easy solution, and all the elements for its solution may, in truth, be present; but it is surrounded with difficulties nevertheless. The great difficulty lies in this, that we have no correct and ready means of measuring, or I had better say of estimating, the extent to which air is charged with ozone. All the rules on this point, as at present supplied, turn out, in practical work, to be fallacious tests. They may show presence; but they do not show quantity beyond a certain degree. The ozone-papers discolour up to a given depth; then they cease to act, and not only so, but on exposure they are apt to become discoloured by other agents, and it seems now that they may lose colour in the air, so that the maximum they have registered may be lost. We have, therefore, as yet, but an imperfect guide as to the presence of ozone and no guide as to the intensity of its action. Further, the determination of the actual presence of ozone may be obscured by other substances which do not probably interfere with its action upon the organism.

Something may be taken into account here in respect to common sensation. I know that, during easterly and north-easterly winds, I have breathed air which to sensation is as much like ozonised air as can well be compared; and I have experienced from such air the same effects as come from ozone—viz., irritation of the throat and nose, and catarrh. In some instances of this kind, the ozone-paper has demonstrated ozone; in others, it has not. Is the test here at fault? I think so. Any way, of this we may be convinced—that ozone cannot possibly be present in the air for many hours, at a temperature above 55° Fahr., without producing in those subjected to its influence some shade of effect. It would not affect all with the same degree of intensity; it does not do so in the course of actual experiment, but in many it would of necessity give rise to catarrh, to bronchitis, to pneumonia, or even to croup.

THE ADMINISTRATION OF OPIUM IN OBSTRUCTION OF THE BOWELS.

By Thomas James Walker, M.D., Surgeon to the Peterborough Infirmary and Dispensary, etc.

Several communications have recently appeared in the pages of this Journal advocating the use of opium in strangulated hernia and in ileus; and although this treatment has no claims to novelty, examples of the mistaken practice of administering