

removal of the appendix hard concretions were felt and seen in the tube; the tube was slit up, showing the terminal portion of the mucosa swollen and congested, but not ulcerated. This was the bed occupied by the larger concretion. The concretion was of a bright yellow colour, was composed of semi-soft faecal matter, and was of the size of a small lemon pip. When the concretion was cut into a thread-like object was seen at once and declared by Dr. A. I. Shephard-Walwyn of Wetheral, near Carlisle, to be an oxyuris. Examination with a lens confirmed this.

The appendix removed was sent to a laboratory for report, and in a concretion sent with the slit-up tube two more worms (oxyuris vermicularis) were found, both being immature females. No ova were found in the concretion nor on the mucous surface of the appendix.

I mention this case especially because the discovery of threadworms within concretions in the appendix has been verified, first by Dr. Shephard-Walwyn, and in the second place, in another concretion from the same case, by Mr. Richard Muir, assistant pathologist to the pathological department in the University of Edinburgh. It looks rather as if threadworms may have formed the centre upon which faecal matter collected, a mode of action quite different from the first case, where the worms formed a nest without any faecal matter whatever.

Worms in the appendix have been dealt with at length by Aimé Guinard,<sup>3</sup> and under "Parasites Filiformes" the oxyuris and trichocephalus are stated to have been met with frequently in the appendix in a greater number of cases than is noted in this country. Out of 200 cases of removal of the appendix Guinard found the trichocephalus in 15 and the oxyuris in 3 cases. There can be but little doubt that the oxyuris is occasionally overlooked, especially when it occurs mixed up with faecal concretions, for it was only when the concretions were cut into that the worms were found in my second case. Guinard sums up by saying, "I am absolutely convinced that the parasites can play an important rôle in the pathology of appendicitis." With regard to the habitat of the oxyuris, Guinard states that it is in the ileum, and that the females fecundate and pass into the caecum and appendix until the maturity of their eggs, and they then fix themselves into the rectum, where they excite "les démanagements anales bien connues."

It is not simply in children that the oxyuris is met with apart from appendicitis, but in the cases recorded now it will be seen that one occurred in a girl, aged 7 years, and the other in an adult of 30 years of age.

That a worm could enter the appendix is noted by Dr. James Milman Coley,<sup>4</sup> who stated of the ascaris lumbricoides or common round worm that "their migrations sometimes extend to the biliary or pancreatic ducts or the vermiform appendage of the caecum." No mention is made of the entry of threadworms.

In Kelly's "Appendicitis and Other Diseases of the Vermiform Appendix,"<sup>5</sup> the author states that it has been long known that enterozoa are not uncommon occupants of the appendix, and in numerous cases they have escaped through a perforation into the abdominal cavity. Perforation is denied by Dupallier,<sup>6</sup> but they can act as foreign bodies and determine an ulcerative appendicitis. Kelly remarks that the oxyuris is sometimes found in the normal appendix in large numbers, and may cause attacks of severe spasmodic pain. Aschoff<sup>7</sup> of Freiburg has come into touch in the course of examinations with cases of trichocephalus (2) and oxyuris (2).

It will be seen that the occurrence of parasites in the appendix is probably world-wide, and may in reality be more frequent than it is considered to be if the concretions removed from the appendix were always examined with minute care. In the appendices examined by Aschoff were found the common objects so frequently met with in this country—viz., bristle, hard seeds, sand, and lead, as well as the worms already spoken of.

About eight years ago the occurrence of threadworms in the appendix was the subject of several contributions to THE LANCET, and surgeons who had met with cases recorded

their experiences. Mr. J. Lionel Stretton<sup>8</sup> of Kidderminster met with two threadworms, both females. Dr. G. F. Still<sup>9</sup> of London, in a letter drew attention to a case of a boy, aged 9 years, having 111 threadworms in a swollen and thickened appendix, and he seems to favour the view that threadworms may set up appendicitis. Professor Begouin,<sup>10</sup> in the *Gazette Hebdomadaire des Sciences Médicales de Bordeaux*, contributed a paper on threadworms and appendicitis, and related a case of a woman, aged 24 years, whose appendix contained 15 threadworms, with ulceration of the mucous membrane. Mr. J. Hutchinson, jun.,<sup>11</sup> found an appendix full of lively threadworms, but the occurrence was exceptional in his practice at the date his letter appeared. Von Motz,<sup>12</sup> in the *Écho Médical du Nord*, 1902, p. 217, stated that he had met with the oxyuris in the appendix, and considered that chronic appendicitis might be induced by the trichocephalus or the oxyuris.

With regard to the pathology of these cases, I do not think any doubt rested in the minds of those who were present at the operation in my first case (that of the girl aged 7 years) that the acute abdominal symptoms (temperature 103° F., vomiting, pain, distension) and the reddened and inflamed appendix were conditions due to the presence of the worms, but whether one or two worms would produce the same effect may be open to doubt.

In my second case there were no loose worms, because they were enclosed in concretions of somewhat soft faecal matter, and the inflamed portions of the mucous coat of the appendix were due in all probability to the irritation of the concretions and not to the worms.

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## A NOTE ON THE TOXICOLOGY OF CARBON MONOXIDE.

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As a consequence of the increase in the use for heating and illuminating purposes of mixtures of coal-gas and carburetted water-gas, the profession and public have become familiar with the toxic and often lethal effects of carbon monoxide. However, the two cases which I describe below seemed worthy of reporting on account of the circumstances which led to the formation and escape of the poisonous gas into the air of the rooms. In one the carbon monoxide was a product of imperfect combustion in a gas-stove which was unprovided with a flue, whilst in the other its escape was due to the fusion of a lead gas-pipe by a leaky electric wire.

CASE 1.—On Dec. 22nd, 1909, at 7.30 A.M., the bodies of a man and woman, aged 35 and 30 years respectively, were found in a small office in Belfast. The room, which measured 15 feet in length, 10 feet in width, and 10 feet in height, was unprovided with a fireplace, and had a tightly-fitting door and windows, which were found closed. The man was dead when admitted to the hospital, and the woman died a week later. A post-mortem examination of the body of the man revealed the usual appearances presented by carbon monoxide poisoning, and the blood was found to be saturated to the extent of 60 per cent. with this gas.

At the inquest the jury found in both cases that death was due to carbon monoxide poisoning, resulting from imperfect combustion of the gas in a gas-stove, and recommended that the gas authorities should not supply gas-stoves unless a proper flue for carrying away the fumes was also installed. The imperfect combustion resulted from the fact that owing to the clogging of the burners the stove had "struck back." The evidence showed that the deceased had probably been 10 hours in the office. It may seem remarkable that the victims did not discover that the stove was at fault, but I find it is no uncommon thing to see a gas-stove or grate in use in this condition, the owner being unaware that it is not burning properly.

The results of a few experiments I made with regard to the production of carbon monoxide in gas-stoves are as follows. An examination of a gas fire (i.e., a fireplace

<sup>3</sup> Nouveau Traité de Chirurgie Clinique et Opératoire, A. Le Dentu, Pierre Delbet, xxiv., Affections Chirurgicales de l'Abdomen, 1910.

<sup>4</sup> Practical Treatise on the Diseases of Children, 1846, p. 229.

<sup>5</sup> Second edition, 1909.

<sup>6</sup> Thèse de Paris.

<sup>7</sup> Die Wurmfortsatz Entzündung, 1908, pp. 6-7.

<sup>8</sup> THE LANCET, Sept. 27th, 1902, p. 895.

<sup>9</sup> THE LANCET, July 12th, 1902, p. 125.

<sup>10</sup> THE LANCET, Sept. 8th, 1902, pp. 687-688.

<sup>11</sup> THE LANCET, Sept. 30th, 1902, p. 837.

<sup>12</sup> THE LANCET, Nov. 1st, 1902, p. 1211.

containing pieces of asbestos heated to redness by a row of Bunsen burners) showed that the amount of carbon monoxide given off into the air over the fireplace was inappreciable when the burners were properly lighted. When the burners "struck back" traces of carbon monoxide were given off. In one experiment 0.013 per cent. of carbon monoxide was found to be present in the air over the fire. When an ordinary Bunsen burner "strikes back" I find that the air escaping from the top of the burner may contain as much as 0.2 per cent. of carbon monoxide, and Haldane has shown that an atmosphere containing this amount of the gas is incapable of supporting life. The gas-stove associated with the unfortunate occurrence contained nine burners, the flames of which impinged on three perforated iron plates, and it is possible that these plates when red-hot contributed to the production of carbon monoxide. There was an asbestos tile behind the burners, but there were no asbestos "bricks" in the stove. I have an impression that when the products of combustion have to pass through incandescent pieces of asbestos more complete oxidation of them occurs. It is interesting to note that the man was found dead near the door, as if he had made an effort to escape and that this effort had accelerated his death, whilst the woman, although lying close to the stove, was still alive. Exercise is known to accentuate the poisonous symptoms even when non-lethal doses of carbon monoxide are inhaled.

CASE 2.—This was the case of a man, about 50 years of age, who was found dead in a bedroom on Jan. 7th, 1910.<sup>1</sup> Death was due to gas poisoning and the blood was saturated with carbon monoxide to the extent of 76 per cent. It appeared from the evidence that the deceased man was in the habit of going to his bedroom for a nap in the afternoon, and that on the occasion in question he had been poisoned by the escape of gas from a  $\frac{3}{8}$ -inch gas-pipe which had fused owing to being in contact with a leaky electric wire. A  $\frac{1}{2}$ -inch gas-pipe and an electric wire had been properly laid parallel to each other and about a foot apart underneath the floor of the bedroom. From the side of the  $\frac{1}{2}$ -inch gas-pipe a  $\frac{3}{8}$ -inch pipe came off at right angles, and in its path crossed the electric wire. At the point of contact fusion of the gas-pipe had occurred. A leakage of electricity had evidently generated sufficient heat to melt the gas-pipe and ignite the gas, which had burned long enough to scorch the surrounding boards, but as the space was very confined there was insufficient air to support combustion, so that the gas flame had become extinguished, and then the gas escaped into the apartment above.

The deceased had not been exposed for longer than two and a half hours to the effects of the gas. There was a fireplace in the room and the window was partly open at the time. Knowing the area of the room and the rate of escape of the gas, &c., I made a calculation to determine whether a poisonous atmosphere would have resulted if ordinary coal-gas had been in the pipe, and came to the conclusion that in that case death would probably not have occurred.

Haldane has shown that with coal-gas it is almost impossible to produce a poisonous atmosphere in a room by simply leaving the gas turned on during the night, whereas with water-gas a poisonous atmosphere is easily produced even in very large rooms. In conjunction with Mr. Harold Totton, B.Sc., I made an analysis of the Belfast gas-supply at this time and found that it contained on an average 20 per cent. of carbon monoxide. Ordinary coal-gas contains from 6 to 8 per cent. of carbon monoxide and carburetted water-gas from 30 to 32 per cent., so that the Belfast supply contained a mixture of about equal parts of these gases.

Haldane has also shown that deaths from carbon monoxide are enormously more frequent in cities using coal-gas mixed with carburetted water-gas than in cities in which coal-gas only is consumed. From statistical data he concluded that the number of accidents referable to the use of mixed gas would appear to increase approximately as the cube of the gain in percentage of carbonic oxide. Thus, if the percentage of carbonic oxide were increased from 6 to 12 the chance of being poisoned was not twice or even four times, but eight times as great as before the increase, and if the carbon monoxide became three times as abundant as heretofore the chances of being poisoned became increased no less than

27-fold. Carburetted water-gas began to be introduced into the Belfast supply in 1892. A return obtained from the coroner's office at Belfast showed the number of deaths from gas poisoning during the years 1889 to 1891 and 1907 to 1909 was as follows: 1889 *nil*, 1890 *nil*, 1891 one, 1907 two, 1908 five, and 1909 seven. Of course, there has been a great increase in population and in the use of gas since 1889, still a very large proportion of the deaths must undoubtedly be attributed to the increased amount of carbon monoxide in the gas-supply. Only one of the above deaths was due to suicide; all the others were occasioned by misadventure or accident.

McWeeney has shown that from the year 1880 to 1900 no death in Dublin was tabulated by the Registrar-General as having resulted from coal-gas poisoning, that the supply of carburetted water-gas mixed with coal-gas commenced at the beginning of 1900, and that during the four succeeding years there had been in Dublin 10 cases of gas poisoning resulting in 7 deaths. None of these deaths were suicides.

In America, where carburetted water-gas has been in use since 1880, the number of deaths from gas poisoning is enormous. The records of New York are instructive. From 1867 to 1880 there were 16 cases of gas poisoning; from 1880 to 1892 the number was 202. During recent years the number has increased still further, many of them being cases of suicide; for instance, in 1906 there were 419 deaths in New York due to gas poisoning, and of these 250 were the result of accident and 169 of suicide.

The facts which I have mentioned show how urgently such measures as the following are needed to prevent this wastage of life: 1. A limit should be put by Act of Parliament on the amount of carbon monoxide allowable in a gas-supply. The Departmental Committee recommended that the amount of carbon monoxide in the night supply should not exceed 12 per cent. 2. The inspection of gas-fittings and the prohibition of the use of gas-stoves unless provided with a flue. 3. Where the gas-supply of a town contains a large proportion of carburetted water-gas the householder should cut off completely the supply of gas to his bedrooms. The resulting inconvenience would be trifling compared with the risk which is otherwise incurred.

*Bibliography.*—J. S. Haldane: Appendix to the Report of the Departmental Committee appointed to Inquire into the Manufacture and Use of Water-gas, &c., 1899; also Journal of Physiology, vols. xviii, xx., xxii. E. J. McWeeney: Scientific Proceedings of the Royal Dublin Society, 1904. Belfast.

## THE VENTILATION OF SHIPS, PARTICULARLY MERCHANT SHIPS.<sup>1</sup>

BY FLEET-SURGEON W. E. HOME, R.N.

WHEN men begin to live together in society, I suppose their first reasoned step in hygiene concerns itself with the disposal of their excreta. Their earliest sanitary concern is to get safely rid of their solid and liquid dejecta. With these we have at sea no difficulty, but the gaseous excreta it is that are always giving us trouble in their removal.

Your houses ashore are severely limited in size, for reasons of economy, but ours even more. In the cost of ours must be reckoned, not only the capital expenditure, but the continuing expense of carrying them about on voyages. Each member of the crew adds for his accommodation two tons to the bulk of the ship; it will soon be three, and there are people asking for more. Thus it will be seen how difficult it is for owners to give more room to the men, and for us to get them satisfactory, that is, draughtless, ventilation into the very small spaces in which they live. While you, under protest, accept 300 cubic feet as the limit in a common lodging house, and require 600 in barracks, we at sea are jubilant because the Merchant Shipping Act of 1906 has enlarged the minimum cubic space for a merchant seaman, in ships laid down after 1906, to 120 cubic feet or 3 tons (albeit with deductions), a great advance on the 72 cubic feet formerly prescribed. Liverpool is trying to get 400 cubic feet per adult in houses let in lodgings. The emigrant who leaves Liverpool need only have 15 square feet of area on a deck 7 feet high, or 105 cubic feet, or perhaps, I think, 170 cubic feet on a lower deck less well lighted and

<sup>1</sup> THE LANCET, Jan. 15th (p. 209) and 22nd, 1910 (p. 272).

<sup>1</sup> A paper read at the Congress of the Royal Sanitary Institute at Brighton on July 9th, 1910.