Other foreign bodies recorded are the following: Pieces of bone, pieces of fish-fin, bristles of a toothbrush, fish-bones, a nail, and parasites—*Ascaris lumbricoides*, *Oxyuris vermicularis*—and a segment of tapeworm. Barnet and Macfie² have published a case of gangrenous appendicitis in a hernial sac in which a clove was found protruding from the perforation in the appendix. The patient had not had the opportunity of swallowing cloves since eating an apple pudding a month previously, when he recollected doing so. Apple-pips, grape-seeds, and fig-seeds have also been found. Calcareous enteroliths and true gall-stones are very rarely seen. Battle³ has suggested that the increase in the frequency of appendicitis in recent years may be due to minute particles of iron derived from the rollers used in grinding wheat. He suggests that these particles find their way into the appendix, where they form the nucleus of a concretion, and he has been able to demonstrate the presence of such a nucleus. Battle⁴ also collected four cases in which hairs were present, and in some of these concretions had formed around them.

If sharp points exist, foreign bodies may, and often do, perforate the wall of the appendix and cause acute symptoms of peritonitis. Acute symptoms may be due to the penetration of the inner coats without actual perforation of the peritoneum. Battle quotes such a case recorded by MacDougall.

As regards the frequency of foreign bodies in the appendix, different authors have recorded varying statistics. A. O. J. Kelly had only one case (a pin) in 460 operations for appendicitis. Bell met with 5 cases in 1,000 appendicectomies. Murphy states that they occurred in 3.5 per cent. of his cases, Fitz in 1.2 per cent., while Mutterlich gives 12 per cent. as the result of his experience. At the Johns Hopkins Hospital 4 cases were met with in 1,000 operations for appendicitis. Probably this discrepancy is due to the degree of care with which concretions are examined for a foreign body as their nucleus, and possibly also to the inclusion of concretions by some authors under the heading of foreign body. Personally, I have examined several hundred appendices, and this is the first case in which I have found a foreign body, with the exception of threadworms, which I have noted in several instances. I must admit, however, that I have not always examined concretions carefully for a nucleus.

It is highly probable that, if a foreign body has sharp edges or points, which presumably may easily abrade the mucous membrane, inflammatory changes are produced in the appendix sooner or later in all cases, bacterial invasion of the wall readily occurring. It is possible, however, that the onset of symptoms may be delayed for a considerable period, as several cases have been recorded in which appendicitis, due to the presence of a pin, has not developed until several months after the foreign body was swallowed. Micro-organisms can probably pass through the mucous membrane without any gross abrasion, and their number and chances of flourishing would be greatly increased by the presence of foreign bodies; so that even a smooth foreign body may lead to inflammatory changes in the appendix. The presence of threadworms may also lead to such changes, as it has been proved that bacteria flourish more abundantly in their neighbourhood. It has even been asserted that threadworms may penetrate into the mucous coat. The escape of the foreign body back into the caecum may be prevented by valvular formations of the mucous membrane, by kinks, either congenital or produced by adhesions, or by stricture produced by ulceration. Inflammatory infiltration of the muscular coats, which would prevent peristaltic contraction, may also prevent the passage of the foreign body back into the bowel. Later on, the formation of a concretion around the foreign body may also prevent its escape. On the other hand, Howard Kelly⁵ thinks that smooth rounded foreign bodies may produce no inflammatory change, and are possibly expelled into the caecum. Cases have been recorded in which a large quantity of shot has been present in the caecum and appendix without causing any symptoms.

Normally, the small size of the opening into the appendix prevents foreign bodies from entering it. Birmingham⁶ thinks that the valve of Gerlach has very little to do with it. In my case, the unduly large lumen probably favoured the entrance of the foreign bodies, and

they were then carried, possibly by reverse peristalsis, towards the tip, although the movements of neighbouring coils of intestine may have assisted in their migration. In this connexion the observations of Cannon and Murphy⁷ are of interest. By means of observations of bismuth meals with the Roentgen rays, these experimenters found that where there is an insuperable obstruction in the small intestine, violent efforts are made on the part of the muscular coats to overcome it, but after a time, these efforts failing in their object, the intestinal contents are forced backwards in the opposite direction, probably by a process of reverse peristalsis. A similar process possibly takes place in the appendix.

REFERENCES.

- ¹ Kelly and Hurdon, *The Vermiform Appendix*. ² Barnet and Macfie, *Lancet*, August 24th, 1907. ³ Battle, *Lancet*, August 24th, 1907. ⁴ *Ibid.* ⁵ Loc. cit. ⁶ *Textbook of Anatomy*, edited by D. J. Cunningham. ⁷ Cannon and Murphy, *Movements of the Stomach and Intestines in some Surgical Conditions, Report of Research Work of Harvard University*, December, 1908.

ON THREADWORMS IN THE VERMIFORM APPENDIX.

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THE connexion between threadworms and the vermiform appendix has not long been recognized, but evidence is accumulating which would appear to show: (1) That the appendix is by no means an uncommon nursery for the *Oxyuris vermicularis*; (2) that these small worms may be the direct cause of appendicitis; and (3) that obstinate cases of threadworms which resist repeated courses of treatment may often, and perhaps generally, be thus explained. A recent case illustrates these points.

In September, 1911, I was consulted by a lady, aged 35, who had suffered from grumbling pain in the right iliac region, with occasional exacerbations, for several years, and who had also had recurrent attacks of threadworms, which many courses of treatment by anthelmintics, administered both orally and by enemata, had failed to cure. I was fortunate enough to see the case when slight fever and marked McBurney tenderness pointed clearly to an attack of subacute appendicitis, and when also some threadworms were present in the motions. After the attack had subsided, leaving only some grumbling pain and doubtful tenderness, the appendix was removed. It was found to be kinked and swollen, and the inner coats were greatly congested and thickened, while a careful search revealed the presence of a single threadworm and a single ovum. It is now six months since the operation was performed, and the patient is apparently quite cured not only of her abdominal pains, but also of her tendency to be troubled by threadworms, though no anthelmintic treatment of any kind has been resorted to.

It is strange that more threadworms were not found in the appendix in this case, but no evidence of their presence would have been discovered at all had not a very careful search been made, and it is probable that *Oxyuris* may exist as a cause when none can be found in the removed appendix. Such a finding is, however, probably quite uncommon. In Dr. Macdonald's case¹ "two distinct collections of *Oxyuris vermicularis* were seen towards the base." In "several" of Mr. Burgess's "Five hundred consecutive operations for acute appendicitis"² small threadworms were present; while in one of Dr. G. F. Still's cases³ no less than 111 worms were found in an inflamed appendix.

To Dr. Still, who devotes six pages to a discussion of this subject, we owe the knowledge that this class of case is by no means uncommon among children. "In a series of one hundred necropsies on children between the ages of two and twelve years threadworms were found in thirty-two cases—that is, in 32 per cent."; and in two-thirds of these cases they were found in the appendix. "Moreover, the appendix is in some cases the only part in which the threadworm is found." Dr. Still concludes that the appendix is a common breeding ground for the small parasite, and that the "extreme obstinacy" in some cases, "in spite of all treatment . . . becomes at once intelligible."

Among adults threadworms are fortunately much less common than in children, but when they do occur they are often extremely intractable, and it is probable that one

only has to approach such cases with the above considerations in mind to discover some evidence of appendix irritation in a large proportion. Finally, even in the absence of such evidence, the chances of failure to cure a case of threadworms, without removal of the appendix, should receive consideration, for it seems probable that the really obstinate cases may all be explained by the fact that there is a nursery beyond the reach of drugs passing through the intestine. Another case is doubtless an illustration of what is possibly a fairly common type. Twelve years ago a lady aged 26 complained that no one had been able to cure her of threadworms, from which she had suffered since childhood. At that time I had never met with an incurable case, and felt pretty confident of finally relieving her. But I failed, and the affection continued intermittently until four years ago, when, visiting relations, she developed an attack of appendicitis, and was operated on; and now she is free from the pest which troubled her both physically and mentally for so many years. Though proof is wanting, the explanation is fairly obvious.

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- ¹ BRITISH MEDICAL JOURNAL, 1912, vol. i, p. 485. ² *Ibid.*, p. 415.
³ *Common Disorders and Diseases of Childhood*, 1909, pp. 267, 271.

FOREIGN BODIES IN THE INTESTINE.

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THE following case is of interest as an illustration of the manner in which Nature is sometimes capable of dealing with foreign bodies in the intestines. The patient was a male lunatic aged 33, who complained of pain in the abdomen, and whom I was asked to see late at night.

I found him lying on his back with his legs flexed upon the abdomen. His pupils were dilated, he had a temperature of 100°, a pulse of 112, his tongue was clean, and his bowels were said to have acted that day. He had not been sick. I was informed that he had on previous occasions passed stones (not gall stones). The abdomen was slightly distended and tender all over; it moved fairly well on respiration, was tympanitic, and nothing definite could be made out. Nothing was detected per rectum, and having excluded as far as possible all forms of external strangulated hernia, and finding no physical signs in his chest, he was ordered an enema and restricted to fluids.

The next morning (January 20th, 1911) he was much the same. He had slept well, there had been no result from the enema, he had not been sick, his temperature was 100.6°, pulse 112, and his tongue clean. He was ordered another enema. In the evening at six his temperature was 100°, his pulse 120, and although there was still no result from the enema he seemed somewhat better. He was ordered ol. ricini, 3 jss.

The next morning (January 21st) his temperature was 101°, pulse 120, and his tongue was still moist and clean; urine normal. The abdomen was now well distended and tender, no peristalsis was visible, but there was resistance over the sigmoid flexure, which was dull to percussion, but still nothing definite could be made out. There was no vomiting, and as the bowels had not acted he was again ordered a large enema, but still with no result. Some flatus came away, and he was ordered calomel gr. viii & belladonna.

On the 22nd the patient seemed better, the temperature was 98.4°, pulse 116, his tongue was furred and he had not been sick. The bowels had moved, and very offensive dark liquid material mixed with mucus came away. There was less abdominal distension, but there was still dullness over the sigmoid flexure. He was ordered ol. ricini 3j.

On the 23rd he was no worse, his temperature was 100°, pulse 120, there was no sickness, and the bowels had acted, but only the same offensive material coming away. There was still some abdominal distension, and by now a mass could be made out in the sigmoid flexure, which was dull to percussion and painful.

In the evening his temperature had risen to 101.6°, his pulse was 120 and soft, he had not been sick, and the bowels had acted again, the same offensive material coming away. He was quite comfortable.

On the 24th there was a hard substance now easily detected in the sigmoid flexure, which was irregular in outline and painful and dull to percussion. His temperature was 100.6°, pulse 120, and tongue furred. He was not sick, and he was still passing the offensive material. In the evening he continued much the same, and one felt fairly certain that he was dealing with a case of a foreign body causing obstruction.

On the 25th he did not seem so well, his temperature was 99°, and his pulse was 120, and he had not been sick. There was now marked abdominal distension and especially on the right side. The abdomen was tender on palpation, and not only the sigmoid flexure, but the whole of the descending

colon also was found to be quite dull to percussion and entirely filled with some hard material forming one long continuous dullness, whilst the other parts were tympanitic and much distended. An examination of the rectum revealed nothing except liquid faeces, so he was ordered another enema and visited soon after. After the enema had been given and with little result, the bowels acted themselves in the course of an hour or so, and he passed a very hard substance which was very offensive and which on subsequent examination proved to be a piece of wood measuring 3½ in. long by ¾ in. thick, and pointed at one end, the whole enveloped in a piece of blanket 13 in. long by 1½ in. wide, and covered with hard faecal material. After this had come away the abdomen was again examined, and the hard irregular substance which was so obvious in the sigmoid flexure was missing. He slept in the afternoon, and early in the evening he again passed another mass, which proved to be a similar piece of blanket 9½ by 1½ in. firmly wound round smaller pieces of wood, the largest of which was 2½ by ¾ in. After this had come away he felt considerably better, his temperature was 101.6° and his pulse 120. The abdominal distension was now much less, and one could still make out something hard in the sigmoid flexure and descending colon, which was considered to be more foreign material of some kind.

On the 26th he seemed much better. The temperature was 99°, his pulse 120, regular, tongue still furred. The bowels had been open two or three times during the night, and more foreign material had come away, including wood, blanket, pieces of stone, coal, buttons. The abdomen was now much less distended, and although painful, more foreign material could be made out in the sigmoid flexure and descending colon. No further treatment was employed, and in the course of the day his bowels had acted many times, the patient still passing pieces of blanket, shirt, jacket, stones, buttons, etc.

After this date the patient passed no more foreign bodies, rapidly improved in condition, and within about ten days his convalescence was complete.

The time occupied in the passage of the various articles was 24 hours, during which period the following things came away:

- 14 pieces of wood, ranging in size between 3½ in. by ¾ in. and 1 in. by ½ in.
- 12 pieces of stone, ranging in size between 2 in. by 1 in. and ¾ in. by ½ in.
- 20 pieces of cloth, ranging in size between 12 in. by 1 in. and 1 in. by 1 in.
- 10 pieces of cotton neckties, ranging in size between 13 in. by 1½ in. and 4½ in. by 1½ in.
- 40 pieces of blanket, ranging in size between 13 in. by 1½ in. and 2 in. by 1 in.
- 19 pieces of fustian and corduroy, ranging in size from 12 in. by 1 in. to 2½ in. by ½ in.

To complete the list the following must be added to the foregoing: 8 linen buttons, 4 brass buttons, 5 match stalks, 1 overcoat button, 1 piece of tape 3 in. long, 5 boot-laces 6 in. long, 2 pieces of linen shirt 6 and 9 in. long respectively by 2½ in. wide, the bottom piece of a match-box, a sharp piece of the bowl of a clay pipe (¾ in. square), besides several large pieces of coal, rolled-up paper, wool, and 7 long pieces of knotted handkerchiefs, etc.

The case is of interest, not only from the number of articles that came away, but also from the fact that no complete obstruction was caused in any part of the alimentary canal from the oesophagus downwards, that the ileo-caecal valve formed no obstacle to their passage, and moreover that there was no perforation. That inflammation (if not ulceration) of some part of the gut occurred there is no doubt, from the physical signs and from the offensive material which came away.

The sequela of this case is probably even of greater interest than the original condition of the patient, inasmuch as in my opinion and also in the opinion of my colleague, who took the case over during my temporary absence, there were absolutely no physical signs to indicate the presence of any further foreign bodies, indeed the physical signs and symptoms were those of a healthy individual. The patient was ordered, both by myself and my colleague, to be kept under constant observation, and therefore practically speaking could have had little opportunity of swallowing further foreign material, yet, as the sequela will show, the patient had numerous foreign bodies in his intestines at the autopsy which was held on February 24th. The case is as follows: On February 6th, namely, six days after the patient had been declared to be convalescent and was up and about taking ordinary food and apparently in a normal state of health, he was sent to bed with diarrhoea. He had no temperature, but the abdomen was slightly distended and tender all over.

The next morning (February 7th) the diarrhoea was better. There was no temperature, but the abdomen was much the