attribute this to the toxins absorbed from his abscess. It is one thing for the peritoneum to absorb pus; it is quite another matter for the system to absorb toxins. Relief of tension is the best method of prevention, and I believe that this unfortunate event would not have occurred if the abscess in the first instance had been surgically drained.

In doubtful cases, where the presence of pus is uncertain but there is an inflammatory mass, there is much to be said for the operation of coeliostomy. Drainage, preferably with corrugated rubber, may with advantage be made down to the appendicular lump, and discharge, or resolution, hastened in this way. Immediate operation should not always mean immediate appendicectomy, but rather the relief of intraperitoneal tension. If there is scope for this the general principle for the urgency of surgery is unaltered, and I do not think that the watching and waiting policy is likely to be revived in the case of general peritonitis, except in those cases where the condition of the patient does not appear to warrant any operation. Anything short of appendicectomy here appears to be rarely successful, and if the patient will not stand this by all means give Nature a chance to localize the infection.

In conclusion I would suggest that the treatment of acute appendicitis should now be standardized on the following lines irrespective of the length of the illness:

For acute appendicitis limited to the appendix, appendicectomy without drainage.

For appendicitis with general peritonitis, appendicectomy with cleansing of the peritoneum and perhaps temporary drainage.

For appendicitis with local peritonitis, relief of tension with subsequent appendicectomy.

The last suggestion is not intended to imply immediate operation in all cases, and treatment by physiological rest and the application of heat may be as successful in the treatment of acute inflammation in the right iliac fossa as in other parts of the body.

Treatment which is based on success gradually becomes standardized by the profession and recognized by the public. Experiment gradually gives place to routine, and it is our business to see that our practices are based on sound principles. Immutability is not to be expected in human affairs, but pathological laws do not change greatly, and to lower the mortality of a disease we must either prevent it, or fashion our cure to meet the disease when its victim will best respond to the treatment.

REFERENCES.

¹ *Brit. Journ. of Surg.*, October, 1920. ² *Lancet*, November 11th, 1922. ³ *Brit. Journ. of Surg.*, April, 1923, and October, 1924. ⁴ *Practitioner*, June, 1905.

An Address

ON

APPENDICITIS.

DELIVERED AT THE NORTH-EAST LONDON POST-GRADUATE
COLLEGE ON FEBRUARY 16TH, 1925,

BY

JAMES SHERREN, C.B.E., F.R.C.S.,
SURGEON TO THE LONDON HOSPITAL.

DURING the year 1923, according to the Registrar-General's statistics, there were 2,826 deaths (1,608 male and 1,218 female) registered as due to appendicitis in England and Wales. There has been a little fluctuation in the death rate from year to year, but this was the largest number of deaths yet recorded; in 1913 it was 2,529 (1,387 male, 1,142 female). These figures cannot be considered exact, as cases of resulting intestinal obstruction, peritonitis, or other direct complications are not necessarily included, but they do give us an approximate idea. When we consider that the majority of cases of acute appendicitis occur in the young it is a serious figure, and in itself would be sufficient excuse for venturing to take up your time by speaking to you on a subject about which you might think there was nothing more to be said.

The damage done, however, is by no means limited to this loss of life. Among those that recover, in many there

has been an enormous waste of working time and much suffering that could have been prevented if the condition was surgically treated while it was still appendicitis. In the hospital to which I am attached we still get these cases too late—for example, in the twelve months preceding September 30th last 102 cases of acute appendicitis (57 male and 45 female) were admitted to my firm's beds at the London Hospital; of these only 27 were within the first twenty-four hours of the attack—the most favourable time for operation—and these were almost the only cases which could be treated as uncomplicated appendicitis. We should have advanced far from the day when it was stated, "The disease is essentially a variety of peritonitis; its manifestations, its effects, and its possibilities are those only of peritonitis. Whatever be the antecedent condition, an attack of appendicitis is not in evidence, and, indeed, does not exist until the peritoneum is implicated."¹ We should now say that the disease has ceased to be simply appendicitis when this has happened, and that cure is no longer certain by simple removal of the appendix.

I wish specially to direct attention to the symptoms, particularly, but not entirely, in so-called chronic appendicitis. I say advisedly, as I have repeatedly said before, pain starting in and confined to the right iliac fossa is not the symptom of appendicitis. This conception of the symptoms dates, I feel sure, from the time when much of our knowledge was based on swellings in the right iliac fossa; the disease was called perityphlitis, of which inflammation of the appendix was not the only cause. No surgeon saw the case while it was still appendicitis; he was not called in until pus was diagnosed and the pain had become right-sided. That is, however, ancient history, and yet the number of individuals with right-sided pain who are admitted to hospital as acute or chronic appendicitis, or are seen after the appendix has been removed, without relief, shows no diminution. It is for these reasons—delay in submitting cases to operation and want of appreciation of the exact symptoms—that I consider there is still need for education in the matter of diagnosis and treatment.

Sometimes the delay in operating on acute cases is on the part of the public, who think, excusably, that as the appendix is on the right side, pain produced by its inflammation must be right-sided also. But in the majority of cases the patient has seen a medical man, and here there should now be no excuse for delay in recognizing the condition because the pain is general; on the other hand, cases of right-sided pain are still sent into my beds at hospital by medical officers of that institution as appendicitis.

There is now no sufficient reason for considering the symptoms of appendicitis to consist of pain in the right iliac fossa. Even the early writers on acute appendicitis in this country correctly realized its symptoms and mentioned the general nature of the pain, although they did not lay sufficient stress on it or always act on that knowledge. Treves spoke of it, but in the greater part of his writings this was not insisted upon, and in his last contribution² these words occur: "Removal of the appendix is also to be recommended in chronic appendicitis, in those examples in which there are no active attacks but in which there is abiding discomfort in the right iliac fossa with exacerbations of uneasiness." These, of course, are the cases in which appendicectomy is unlikely to bring relief. Tubby,³ in his excellent little monograph, published twenty-five years ago, was one of the first to direct sufficient attention to it, and writes: "A sudden and severe pain in the abdomen is in nearly every case the first symptom. Its situation is, during the first twenty-four to thirty-six hours, all over the abdomen." Lockwood⁴ also drew attention to it. Battle and Corner⁵ are perfectly clear on this matter. In a paper read at the Medical Society in 1907 by Sir Holburt Waring⁶ on "Some surgical affections of the right iliac fossa which simulate appendicitis," he wisely prefaced his illustrative cases with this observation: "I shall also restrict my remarks to those cases in which the cardinal clinical symptoms of an attack of acute or subacute appendicitis have been manifested—by these I understand abdominal pain commencing usually in the umbilical or epigastric region." In the most widely read student's textbook of surgery (Rose and Carless) the symptoms are correctly given, as they are in

the admirable article on the subject in the new edition of Choyce's *System of Surgery*.

Early in my dealing with this disease I recognized that pain confined to the right iliac fossa was not a symptom of appendicitis, acute or chronic. The first case that brought this home to me was in 1905, when I operated on a girl of 18 with pain in the right iliac fossa of three days' duration, in whom careful examination of chest and urine had failed to elicit any abnormality. Operation revealed a normal appendix, and the pain recurred as before. It was not long before I was convinced of the failure of appendicectomy to cure cases of right-sided pain in so-called chronic appendicitis; the results demonstrated the incorrectness of the diagnosis. I have taught for at least fifteen years that right-sided pain is not evidence of appendicitis, and I have published these remarks in several papers. It seems obvious from what I have quoted that the teaching in the hospitals of London must be on correct lines, as I have mentioned teachers at most of them. In spite of this, however, it seems difficult to get the correct symptoms realized; the idea is still fixed among many that appendicitis is the cause of right-sided pain. It may be the mental effect of the situation of the appendix, allowing the pain to fit its anatomical position, but it is most likely due to want of sufficient accuracy in teaching and writing, and also lack of differentiation between pain and tenderness.

In acute appendicitis the pain in the first instance is generalized, it is diffuse, usually umbilical or epigastric, and only later, when there is peritonitis or local peritoneal irritation, is the pain in the right iliac fossa. In a first attack of acute appendicitis the pain never starts in the right side. Appendicitis should be the last, not the first, disease to think of in a patient with pain starting in the right side of the abdomen. It is conceivable that if the appendix is buried in adhesions as the result of a previous acute attack the pain may commence locally. In a considerable experience of this condition I have known this to happen twice only. When we come to consider the cause of the symptoms, the overdistension of the appendix or irritation of its wall, it is obvious why the pain is generalized. The nerve supply is from the abdominal sympathetic, and it is not until there is irritation of parietal peritoneum or structures beneath it that the pain is local. The march of the symptoms is always the same—pain first; it never starts with vomiting, diarrhoea, or a rise of temperature. We are all familiar with attacks of pain in the right side of the abdomen accompanied by vomiting, sometimes by a slight rise of temperature, and more common in women. These are never appendicular in origin, but all need careful investigation, and at present in many of them the most we can say is that they are associated with ptosis. There are, however, more serious causes of acute right-sided abdominal pain, which may necessitate immediate or remote surgical treatment. I would mention leakage from a chronic duodenal ulcer, carcinoma of the pelvic colon, or any part distal to the caecum, tubal diseases, twisted ovarian tumours, renal conditions, and last, but not least, thoracic diseases. The last we should always bear in mind, as it still causes difficulties in diagnosis, and cases of pneumonia are yet often admitted into the surgical beds of a hospital. In some cases an attack of right-sided pain is due to a lymphadenitis of the group of glands in the ileo-caecal region, usually tuberculous in nature. The following is an excellent example:

A nurse was sent into the sick-room with a provisional diagnosis of appendicitis. She had been seized with pain in the right side of the abdomen six days before; it doubled her up and made her vomit. Her temperature was 99°, her pulse 100. The pain was entirely right-sided. Her temperature and her pulse rate remained the same, but her pain increased in severity and there was marked tenderness and slight rigidity in the right iliac fossa. Eleven months previously I had operated on her for tuberculous glands of the neck, and diagnosed a similar condition in the ileo-caecal region. As her condition was getting worse I operated on March 7th, 1924, three days after admission, and found a mass of caseating glands extending upwards from the ileo-caecal angle. I evacuated the mass and closed the abdomen; the pain was at once relieved; she went out a month later, and remains well. The appendix was normal to naked eye and microscopic examination.

Right-sided renal conditions should never be mistaken for appendicitis; the pain is never general, and the sym-

ptoms of the two are entirely different, yet such mistakes are by no means infrequently made. I will give a typical example:

A girl of 18 was sent to see me by her medical man because she had had no relief from appendicectomy. I obtained the following history: for years she had had attacks of pain in the right side, which she described as very bad, and which often made her vomit. Six weeks previously the appendix had been removed during an acute attack, and shortly after leaving hospital she had had further symptoms. On abdominal examination I discovered a definite renal tumour, which proved at operation to be a hydronephrosis.

An attack of right renal colic due to a calculus in the ureter is by no means infrequently diagnosed as acute appendicitis. It has been reported by R. F. O'Neill⁷ that 25 per cent. of the patients in the Massachusetts General Hospital who had operations for ureteral calculi had had a previous operation for appendicitis or some other supposed intra-abdominal lesion without relief.

What, then, are the symptoms of acute appendicitis? There is the onset, usually sudden, of general abdominal pain, often waking the patient from sleep in the early hours of the morning. There may be no rise of pulse rate, and a high temperature is uncommon; it may be normal, but within twelve hours is usually from 99° to 100°. There is at first superficial tenderness, and deep tenderness is present in the right iliac fossa, beneath the liver, or per rectum, according to the position of the appendix, but the initial pain, as felt by the patient, is the same and the superficial tenderness remains the same. The symptoms are perfectly clear—general pain, local tenderness. We can probably all recall cases of this nature in which it was supposed that the patient had eaten something that disagreed or had "ptomaine poisoning," the disease not diagnosed until a swelling in the right iliac fossa made its appearance, or in the former cases matters were precipitated by an aperient. It is a common idea among patients to attribute all pains to some external influence, such as food taken, or to some half-forgotten injury, rather than to definite abdominal disease.

Symptoms such as I have described call for immediate operation. No aperient should be given, nothing but water by the mouth and morphine, if necessary, after the diagnosis has been made. Early removal when the inflammation is confined to the appendix would not only abolish the death rate from appendicitis, but would restore the patient to health and work in a very short time—eight or nine days in bed, and work resumed in four weeks.

Look at the other side of the picture: the patient is seen on the third day with obvious peritonitis; whatever treatment is then adopted—and I shall discuss this later—if recovery takes place it will be after a long illness, resulting in the loss, perhaps, of months of work or education. Or, again, the patient comes under observation on the sixth or seventh day with a localized mass; if operation is performed at once or delayed, much time is lost, and even if the patient returns to work within two months it is usually with a weakened abdominal wall, the result of drainage. There are also the risks of infection of other abdominal organs, the chest, and also intestinal obstruction.

In all that I have to say about the management of the later cases of acute appendicitis I want this to be borne in mind—there is only one treatment, and that is appendicectomy; the question to be discussed is at what time it is safest and best to operate. There is no exception to the rule that in acute appendicitis the appendix should always be removed while the disease is still confined to it; this is usually within the first twenty-four hours; occasionally we may be able to do it later. But if the patient has been seen medically there is no need for even this delay; most could be removed within the first twelve hours, and the earlier the better. Drainage is then unnecessary, and work is resumed within a very short time. When the patient is seen later, either with diffuse peritonitis or with a localized swelling, I am of the opinion, as I have been for many years, that the death rate is less, the disability time shorter, the complications fewer, and the abdominal wall stronger if operation is delayed. In the first paper that I published on the treatment of acute appendicitis, in 1905,⁸ I wrote of these patients that they should be tided over the attack if

possible and the appendix removed later. This has been the rule in my wards at the London Hospital, and nearly twenty years' experience has only served to strengthen the opinion that this is the best treatment. Love⁹ has written two papers on this subject based on a review of over 2,000 cases at the London Hospital under the care of all the surgeons. He found that the mortality in 221 cases operated on within twenty-four hours was 0.9 per cent. Excluding these, of cases which were treated by immediate operation at all stages after the first twenty-four hours the mortality was 5.8 per cent.; of those treated on delayed lines 3.5 per cent. He stated also that complications are three times as common in those late cases operated on immediately. I consider that these two papers are sufficient justification for the line of treatment I have advocated and adopted at the London Hospital since I first began to operate. The only change I have made has been to greater conservatism and more patience in dealing with cases of appendix abscess.

My routine is as follows: If there is reason to suppose the disease is still confined to the appendix, immediate operation; if it is not, the patient is put in the Fowler position, as much water allowed by mouth as is needed, unless there is vomiting, when continuous saline is given by the rectum and the stomach washed out; no aperient or enema is allowed. Morphine is administered subcutaneously if necessary, and a four-hour chart of pulse and temperature is kept. As a rule, within twenty-four hours the condition improves and the temperature begins to fall. I do not allow anything beyond water till the pulse and temperature have settled for twenty-four hours; an enema is given at about the same time. Too early feeding sends the temperature up at once. I have often kept the patient for six or seven days on water in this way. I have been astonished at the way in which large swellings gradually disappear under this treatment. If there is no improvement, the simplest operation is done—drainage; no attempt is made to search for the appendix; it is removed if it presents itself. When an abscess needs opening it should be through a small incision where it is pointing; if it can be felt per rectum it should be left until there is obvious fluctuation and opened by this route and a tube inserted. This can usually be removed in forty-eight hours. When abscesses have been drained or when swellings have taken considerable time to disappear, the patient is sent out and returns in three months for appendicectomy. It is astonishing how few adhesions are present and how usual it is for the appendix to show no sign of perforation, even when, from the escape of a concretion, one knows it has perforated.

The more experience I have of this method, and the more thoroughly it is carried out, the more I am pleased with it. I am convinced it shortens convalescence; the death rate is much less and there is an absence of complications such as intestinal obstruction, residual abscesses, and ventral herniae. But it requires skilful nursing and confidence on the part of the patient and friends. There must be no weakening on the subject of "food to keep up the patient's strength."

Before leaving the subject of acute appendicitis I should like to say a word on the increase of the disease and also on the change in sex incidence. The increase in the number of cases was remarkable between the years 1895 and 1905; this has been shown from the Bristol records by Rendle Short,¹⁰ as well as by myself. The increase has been little since then, although the disease is certainly not on the decline. There has, however, been a remarkable change in the sex incidence. In 1903 I found, in the London Hospital cases, it was 2.5 times as common in the male sex; in the same year Grey Turner¹¹ found it about the same. In 1907 among 311 cases at the London Hospital there were 65 per cent. males; in 1922, among 625 cases, there were only 55 per cent. males. In my own acute cases at hospital in a year before September 30th, the percentage was about the same. This change in sex incidence has also been noted by Rendle Short.

Let us now pass to chronic appendicitis. In spite of all that has been said such a condition does exist, but it is not characterized by pain in the "appendix" region. I hold very strongly that a patient with pain confined to

the right iliac fossa with tenderness is not suffering from chronic appendicitis, and removal of the appendix is unjustifiable. It is because of its failure to relieve pain here that many have become sceptical of its existence. In America, where operations for "chronic appendicitis" were much more common even than in this country, many writers have drawn attention to the failure of appendicectomy to cure. A recent paper had as its title "Chronic appendicitis—is it a myth?"¹² and a dictum of a physician is quoted which runs: "There are two kinds of appendicitis—acute appendicitis and appendicitis for revenue only." Connell,¹³ in a paper on pseudo-appendicitis, records failure to cure in 48 out of 212 patients operated on by himself, and draws attention to the fact that "After eliminating all demonstrable pathologic conditions that might possibly be confused with 'chronic appendicitis,' there remains, in certain cases, some cause for pain in the right iliac fossa, other than the appendix, the exact cause of which is as yet not definitely known."

Stanton,¹⁴ in 1911, wrote as follows: "In our cured cases of chronic appendicitis the pain has been almost constantly referred to as epigastric or mid-abdominal rather than right inguinal. On the other hand, nearly all the patients not benefited by operation complained of right inguinal pain as one of their chief symptoms. . . . Our uncured patients almost without exception complained of pain in the right lower quadrant as their chief symptom." Chalfant¹⁵ stated that "the results of operation for chronic appendicitis are among the poorest in surgery."

In the discussion on the subsequent course and later history of appendicitis after operation, at the Medico-Chirurgical Society in 1905, Treves,¹⁶ who opened it, gave details of cases of failure to relieve. After eliminating such causes as incomplete removal of the appendix and persistent sinus, there were seven cases of persistent pain in the right iliac fossa, two of mobile kidney, and one renal calculus, all obviously cases operated on for right-sided pain.

In 1913 I wrote as follows:¹⁷ "I first wish to direct your attention to pain in appendicitis—in the initial stage of the acute attack; it is generalized, and later shifts to the right iliac fossa. In chronic appendicitis I have been in the habit of teaching that pain is not in the right iliac fossa, and, if here, its principal seat is elsewhere. Less would be heard of failure to relieve symptoms by the removal of the appendix if we were sceptical of the sole appendicular origin of pain which is *limited* to the right iliac fossa."

When cases of pain in the right iliac fossa are excluded, there remain two definite groups in which chronic abdominal symptoms are certainly due to disease of the appendix. It may show itself first by attacks of pain in the abdomen, generalized or in the epigastric or umbilical region, severe but of short duration; and secondly, by dyspeptic symptoms, sometimes accompanied by haematemesis and occasionally by colicky pains and irregularity of the bowels. Removal of the appendix, as I have known it advised, to cure headaches or pains in the joints seems to me unjustifiable unless we have definite evidence from abdominal symptoms that the appendix is diseased.

I am beginning to doubt if it is ever justifiable to operate for what is supposed to be chronic appendicitis through a small incision. Certainly in cases in the second group, in which dyspepsia is diagnosed as being due to appendicular disease, it is never so—the whole abdomen must be explored. I have had to operate on numerous patients with gastric ulcer, duodenal ulcer, and gall-bladder disease in whom the appendix had previously been removed through a small incision in the right iliac fossa on the diagnosis of appendix dyspepsia. I will give examples of both types of disease.

I operated recently on a patient with the following history: A man, aged 32, was transferred to my care at the London Hospital by Dr. Robert Hutchison. He had not been in good digestive health for nine months following a severe attack of epigastric pain which lasted about an hour. Since then he had suffered from flatulence, and had had seven or eight attacks of upper abdominal pain, each lasting about seven hours. He was a stout man with no tenderness in the abdomen. A test meal showed lowered acidity. I explored the whole abdomen on January 23rd, 1925. The gall bladder on external examination

was normal, and there were no enlarged glands. I opened it; the mucous membrane was normal, and bacteriological examination of the bile showed it to be sterile. The stomach and duodenum were normal. The appendix was enlarged to the size of my index finger, and was adherent at its base. On cutting into it its walls were thickened; it was strictured at its base and contained muco-pus.

This is typical of the first group, and the diagnosis can only be made certainly if there is definite tenderness in the right iliac fossa during an attack. To show how necessary general exploration may be I will give you another example.

In 1919 I was asked to see a lady with a view to removing her appendix for dyspepsia. The following was the history given me: a year previously she had waked in the middle of the night with abdominal pain, diagnosed as acute appendicitis. She was kept in bed fourteen days. Since then she had had much nausea and occasional abdominal discomfort, both waking her and keeping her awake, and three months previously a milder attack of nocturnal pain. The report after a barium meal was that she had visceroptosis. Acting on the rule I have laid down, that although you may diagnose appendix dyspepsia you should never act on it—that is, never be content with removing the appendix alone—I found an atrophied adherent appendix, which I removed. On exploring the upper abdomen the cause for her abdominal pain became evident—there was cholecystitis with gall stones.

In chronic appendicitis causing dyspepsia the pain is not right-sided, although during an attack there may be tenderness in the right iliac fossa, and pressure here causes epigastric discomfort. But I wish to press home the fact that in these cases thorough examination of the whole abdomen is necessary at operation; only then can a certain diagnosis of appendix dyspepsia be made.

The object of choosing this subject has been to draw attention to the necessity of early operation in cases of acute appendicitis and to the care necessary in their diagnosis; and secondly, to warn you against too readily diagnosing chronic appendicitis—it is a disease that does exist and cause symptoms, but is not nearly as common as is often supposed.

REFERENCES.

- ¹ Treves: Cavendish Lecture, BRITISH MEDICAL JOURNAL, June 28th, 1902.
- ² Cavendish Lecture, ³ Tubby, A. H.: *Appendicitis*, 1900, pp. 39, 40.
- ⁴ Lockwood: *Appendicitis and its Pathological Symptoms*, 1906, pp. 219-221.
- ⁵ *Diseases of the Appendix Vermiformis and their Surgical Complications*, second edition, 1910, p. 63.
- ⁶ *Trans. Med. Soc.*, vol. xxx, p. 259.
- ⁷ *Journ. Amer. Med. Assoc.*, vol. 77, 1921, No. 6, p. 418.
- ⁸ *Practitioner*, June, 1905.
- ⁹ *Brit. Journ. Surg.*, vol. x, No. 40, p. 520; vol. xii, No. 46, p. 232.
- ¹⁰ *Brit. Journ. Surg.*, vol. viii, No. 30, p. 175.
- ¹¹ Grey Turner: *Northumberland and Durham Med. Journ.*, 1903.
- ¹² Eastman, J. R.: *Surg., Gyn. and Obstet.*, January, 1924, p. 75.
- ¹³ Connell, F. Gregory: *Journ. Amer. Med. Assoc.*, July 29th, 1916, p. 335.
- ¹⁴ Stanton, E. MacD.: *Annals of Surgery*, June, 1911, p. 813.
- ¹⁵ Chalfant, S. A.: *Journ. Amer. Med. Assoc.*, 1922, vol. 78, No. 22, p. 1675.
- ¹⁶ *Med.-Chir. Trans.*, vol. 88, 1905, pp. 431-660.
- ¹⁷ *Clinical Journal*, September 24th, 1913.

AN ANOXAEMIC TYPE OF INFANTILE ATROPHY.

C. A. BOTWOOD,
M.B., CH.B.,

BY

H. S. RAPER, C.B.E.,
M.B., CH.B., D.Sc.,

AND

EDITH WILLOCK, M.B., B.Ch., B.A.O., D.P.H.

(From the Department of Physiology, the Victoria University of Manchester, and the Manchester Babies' Hospital.)

THE term "atrophy" is used to describe a condition in infants which is characterized by an obstinate refusal to gain weight and thrive, in spite of dietetic or medicinal treatment, and in whom no cause can be found to account for this failure to grow. Atrophy is seldom associated with dyspepsia. If this is present at all it is very slight, quite insufficient to account for the infant's lack of progress, and quite possibly a result, rather than a cause, of the condition. In a few cases, however, there may be a history of previous dyspepsia, following which the atrophic state becomes evident; such cases may be classified as dyspeptic atrophies and may or may not respond to dietetic treatment. Again, atrophy may be due to endocrine or vitamin deficiency, and this type responds to the appropriate treatment. There is still, however, a form of atrophy which fails to respond to dietetic, endocrine, or vitamin treatment, and it is with cases of this kind that this preliminary note is concerned.

It is a common experience that at necropsies on cases of infantile atrophy little or no organic change is revealed which throws any light on the causation of the disease. This in itself might suggest that some physiological factor, other

than those mentioned above, is at fault. The idea that these particular cases are due to the disorder of some fundamental physiological function led to the consideration of the possibility of anoxaemia, either general, due to some deficiency in the functioning of the lungs, or local, due possibly to capillary stasis in the intestine as a result of initial digestive disturbances of either a mild or severe type. Regarding the former, it is well known that failure to saturate the blood in the lungs with oxygen, or deficient saturation brought about by other means, can profoundly affect the physiological condition of an animal. The subject has been fully dealt with by Haldane¹ and need not be elaborated here. That cyanosis and anoxaemia may occur in premature infants has been recorded by Bakwin,² who has described the results of treatment of two such cases with oxygen. About the occurrence of local want of oxygen in a tissue or organ, however, we have few or no data. It is true that this must play a part in certain well recognized pathological states—for example, in the liver and kidney in cases of mitral stenosis and in other conditions of circulatory failure, either local or general. Whether simple capillary stasis can occur in a single organ due to localized abnormal conditions and thus be a cause of local anoxaemia is, however, not so certain. It may be remembered that surgical shock is generally believed to be associated with widespread capillary stasis. The phenomena of shock can also be closely simulated in animals under anaesthesia by injection of histamine, which is a product capable of production by tissue breakdown. It does not appear inconceivable therefore that, under certain conditions, dysfunction of a tissue may be brought about locally through the action of toxic substances produced by bacterial action and that this may have, as a concomitant, local anoxaemia due to failure of the capillary circulation.

These were the underlying ideas that prompted us to try the effect of oxygen administration in certain cases of infantile atrophy. The cases are not as a rule cyanosed, but a slight degree of this condition may sometimes be observed. It seemed that a direct answer to the question whether a generalized anoxaemia was present would be best obtained by determining the results of oxygen therapy. On the other hand, oxygen therapy in localized anoxaemia due to capillary stasis would only act by increasing the dissolved oxygen of the blood, and this might be expected to yield good results only if continued for a considerable length of time and if the local anoxaemia were not severe.

The results we have obtained have so far been promising, and although the work is by no means completed it seems worth while placing them on record at this stage of the inquiry, which promises to be a long one. The preliminary experiments were carried out by two of us at the Leeds General Infirmary, through the kindness of Dr. C. W. Vining, but the greater part of the work has been done at the Manchester Babies' Hospital. For the facilities accorded to us there we are very greatly indebted to Dr. Catherine Chisholm. The cases chosen for oxygen treatment have been those which, after a period of dietetic treatment, have shown themselves to be refractory, as judged by failure to gain weight. In these cases digestive disturbances are never a marked feature, although they may occur, and are then of a mild type. When failure to gain in weight was established and the child was still on a diet to which it had not responded, the oxygen treatment was commenced. Thereafter the composition of the diet was not changed, but increased amounts of food were given as necessitated by the increase in weight and appetite of the child. The oxygen treatment was carried out in the small closed cot which was exhibited by us to the Physiological Society two years ago.

It consists essentially of an air-tight box (29 in. by 18 in. by 20 in.) with a glass lid and apertures for admitting oxygen at a known rate and for sampling the air within it. The infant is placed inside on a hammock. A small fan inside serves for mixing the contained air and providing for its movement. No arrangements are made for removing the carbon dioxide which accumulates while the infant is in the cot. In a two-hour period the carbon dioxide content of the air rises to between 2 and 3 per cent., depending on the size of the child and the amount of movement it makes. The oxygen is admitted from a cylinder provided with reducing valve and pressure gauge, and passes through a modified Pitot's tube, whereby, after a preliminary standardization, the rate of flow can be determined. After placing the child in the cot, the