parable—he arrives too late. But the responsibility is not usually his.

I submit these considerations—most of them familiar and obvious—to your judgement, believing, as I do, that in the early recognition of disease and the prompt adoption of remedial measures lies the secret of much of the efficacy of our art.

ACUTE APPENDICITIS AND ACUTE APPENDICULAR OBSTRUCTION.*

[WITH COLOURED PLATE.]

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Most medical men are now agreed that for acute appendicular trouble the only safe course is immediate operation. If this be granted, the all-important matter is the accurate diagnosis of such trouble in its early stages. Reliable diagnosis can only be based on a clear understanding of the pathology of the early stages of acute appendicular trouble, and it is as a contribution to this part of the subject that I would lay before you certain facts.

When we find that patients suffering from acute appendicular disease present during the early stages of such trouble symptoms differing widely, the natural presumption is that the morbid processes responsible for such symptoms also differ. The mere fact that all eventually tend toward a dangerous peritoneal infection is not sufficient reason to class them all under the one generic term "appendicitis."

The appendix as part of the intestinal canal is liable to certain pathological changes. From its structure and relations it is specially liable to be the seat of ulceration and inflammation, but as a hollow viscus it is also liable to acute obstruction of its lumen. Now whilst blockage of the lumen of the appendix has been regarded by many pathologists and surgeons as an important contributing factor in the etiology and in determining the course of appendicitis, acute appendicular obstruction as a distinct pathological and clinical entity has not been recognized or given the attention which its importance demands.

Benda,¹ Klauber,² and recently Heile have all laid stress on the obstructive factor in appendicitis, but have not clearly differentiated between the two conditions, primary inflammation and primary obstruction, as clinical entities. If we set out by recognizing two definite types of acute disease of the appendix—namely, acute inflammation and acute obstruction—then not only does the understanding and the teaching of the symptomatology of acute appendicular disease become much simplified, but the early diagnosis of such disease becomes inevitably more confident and more correct.

Some years ago, when it was customary for surgeons to have to deal with the secondary effects of acute appendicular trouble, this distinction between inflammation and obstruction was impossible; now, however, we should have to deal with the primary appendicular disease when the distinction is tolerably easy and all-important.

It is difficult to realize and still more difficult to teach that we may have an acute inflammation of an organ without any rise of pulse or temperature, and yet it has been necessary to recognize this in the case of appendicitis.

So far as my observations go they indicate that we never meet with a primary acute inflammation of the appendix without a prompt rise of both pulse and temperature. It is the rule, however, in cases of acute appendicular obstruction to have at the outset no appreciable rise of pulse or temperature, and it is ignorance of these important negative signs which has so often led to fatal delay. We must recognize that if acute appendicitis is a serious condition, acute appendicular obstruction is usually more serious, and is the one in which the call for immediate operation is more clamant.

The essential distinctions between the two conditions may perhaps be best emphasized by two illustrative cases.

CASE I.—*Acute Appendicitis.*

A. H., female, aged 31, had felt out of sorts for two days, and on the evening of the second day she began to have pain in the right side of the abdomen and vomited. She went to bed, and her doctor was called in the same evening. He found her looking flushed but not very ill, with a temperature of 100° F. and pulse of 94. There was some tenderness and rigidity in the right lower quadrant of the abdomen. Hot fomentations were applied, and trional gr. 10 given by mouth. Seen early on the following morning, the patient was found to have slept little, was still flushed, temperature 100.5°, pulse 100, whilst the tenderness and rigidity in the right iliac region were more pronounced. Operation was advised, and was carried out in hospital two hours later. Some turbid fluid was found free in the abdomen; a considerably thickened, red, and inflamed appendix was removed, along with an inflamed and adherent portion of omentum. On splitting the appendix its walls were found greatly thickened and oedematous, the mucous lining was turgid, and in two places ulcerated and covered by a layer of muco-pus (see Fig. 1).

CASE II.—*Acute Appendicular Obstruction.*

M. H., male, aged 30, on returning home from a football match was suddenly seized with acute abdominal pain which doubled him up, and he vomited. After lying down for half an hour the pain had almost completely passed off, and he accompanied a friend to the railway station, a mile away. Whilst there he was again seized with acute griping pain, and vomited several times. He came home in a cab and lay down, but the pain continued very severe. At 8 p.m. the doctor was called in. He found the patient suffering acutely from pain in the umbilical region, the abdominal muscles were rigid, more especially on the right side, and there was marked tenderness at a point midway between McBurney's point and the umbilicus; pulse 80, temperature 98°. Heat was applied to the abdomen, and the doctor returned in two hours. The patient had meanwhile had an hour's relief, but was again suffering acute pain; the abdomen was still tender and rigid, whilst the pulse and temperature were normal. A surgeon was called in an hour later, when, as the patient's condition was unchanged, operation was decided on.

The abdomen was opened at 2 a.m.—that is, nine hours after the onset of symptoms. A large distended appendix, green in colour and with a faeculent odour, was delivered through the wound. The proximal half inch of the appendix appeared normal, then there was a slight constriction, and beyond this the organ was three times its normal diameter, tense almost to bursting, and stippled with little yellow areas of focal necrosis on a ground of dark green. The appendix was removed, and the patient did well. On opening the appendix it was found that the distended portion contained faeculent material under great tension, a concretion having become impacted in the constriction, causing an acute obstruction. Apparently the course of events in this case had been that a preceding unrecognized attack of appendicitis had resulted in a constriction, and beyond this a concretion had formed. Then, probably as the result of straining at the football match, some faecal matter had been forced into the appendix beyond the stenosed area, and had been locked up there by the ball valve action of the concretion.

SYMPTOMS OF ACUTE APPENDICULAR OBSTRUCTION.

The first and essential symptom is pain, which as a rule comes on suddenly, is very acute, and is most pronounced in the umbilical region. The pain may be intermittent as in the case cited above, but not infrequently it is constant, though becoming worse at times. Vomiting is usual, but not invariable. Tenderness over the appendix is always present in greater or less degree, and rigidity of the right rectus is usually well marked, though in some cases it may be deceptively slight. The pulse and temperature are of no diagnostic value, for though both may rise within a few hours of the onset of the obstruction, this is not the rule, and when present is usually an indication of a spread of infection through the devitalized wall of the obstructed organ. Obstruction of the appendix does not necessarily produce a reflex paresis of the intestine, and thus the bowels may act even though rapid changes are taking place in the appendicular walls. The distinctive

* The experimental work referred to in this paper was carried out in the laboratory of the Royal College of Physicians, Edinburgh. The expenses of this research were defrayed in part by a grant from the Carnegie Trust.

features of obstruction as contrasted with primary inflammation of the appendix may be briefly stated as the great severity of the pain, the suddenness of its onset, and the absence of disturbance of the pulse and temperature during the initial stages of the malady.

CAUSES OF APPENDICULAR OBSTRUCTION.

The two common causes of acute appendicular obstruction are:

1. Fibrous stenosis of the appendix with plugging of the constriction.

2. Acute kinking of the appendix at a point of abnormal fixation by a band or fold, congenital or acquired.

In the former there has almost certainly been a preceding though possibly unrecognized attack of appendicitis, faecal matter has gained access to the lumen distal to the constriction and the narrowed outlet has become occluded either by inspissated faeces or by a definite hard concretion. A second attack of inflammation in the region of the stricture may rapidly cause occlusion of the lumen at this point and give the composite picture of acute appendicitis and acute appendicular obstruction—undoubtedly a common combination, but by no means an essential one.

Abnormal fixation of the appendix at some point by a band or fold is a very common cause of obstruction. Such a band may be an old inflammatory adhesion the bequest of a preceding attack of appendicitis. In my experience, however, it has more commonly been a congenital fold attached about the middle of the appendix, fixing this part down toward the pelvis. This fold is almost certainly the genito-mesenteric fold described by Douglas Reid.³ Occasionally the kink is due to a fold tacking some point of the appendix upwards. Some of these folds would appear to be congenital, others, associated with a prolapsed caecum, to be the acquired bands described by Lane as the crystallization of lines of force.

In all these varieties, however, the attack of acute obstruction is probably excited by access of faecal matter to the distal part of the appendix beyond the kink. The slight obstruction at the seat of angulation causes reaction in the distal portion of the appendix and the swelling associated with this rapidly accentuates the kink and renders the obstruction complete.

The access of faecal matter to the lumen of the appendix distal to a stenosis or kink is in all probability frequently determined by strain or other traumatic influence. Kelly⁴ noted that trauma, especially indirect injury, was a somewhat frequent cause of acute appendicular trouble where previous disease in the appendix existed. The cases of acute appendicular trouble supervening on an acute intestinal disorder with diarrhoea may be, and almost certainly are, sometimes due to an inflammation in the wall of the caecum, either spreading to or occluding the opening of the appendix, but not infrequently the caecum shows no inflammatory change, and the disease is limited to the appendix. In the latter type of case a concretion is usually found beyond a constriction, and, as Benda has suggested, the probable exciting factor in the attack has been that the enhanced peristalsis of the intestine being shared by the appendix has resulted in the driving of the concretion into the narrowed part, with complete obstruction of the lumen.

RESULTS OF OBSTRUCTION OF THE APPENDIX.

We must now consider the results following a complete obstruction of the lumen of the appendix near its outlet. These can only be ascertained from a study of the combined data of experimental and clinical observation.

Experimental Evidence.—The following experiments were designed to test what was the effect of isolating a portion of bowel such as the appendix, outwith the *prima via*, under various conditions as regards content. The experiments were carried out on cats, and the terminal

portion of the ileum, which contains a large amount of lymphoid tissue in its wall, was used to make an artificial obstructed appendix. The operative procedure was as follows: under ether anaesthesia the abdomen was opened and the caecum and lowest part of the ileum brought out. By means of the thermo-cautery the ileum was divided 5 in. from the ileo-caecal valve, and the cut ends invaginated. Some caecal content was forced through the ileo-caecal valve into the blind lower part of the ileum, which was then cut through with the cautery one inch from the ileo-caecal valve, the cut ends being invaginated. The continuity of the bowel was then established by a lateral anastomosis of the ileum above the upper line of section with the ascending colon. Using such a closed loop of ileum, the following points were then investigated:

Behaviour of:

1. Empty loop—that is, empty except for mucus and bacteria.
2. Loop filled with caecal content (animal on carbohydrate diet).
3. Loop filled with caecal content (animal on rich protein diet.)
4. Loop filled with emulsion of bacteria grown from caecal content.

1. After isolation of an empty loop the animal appears well for a period of days at least, and if killed three days after the operation the loop is found to be slightly enlarged and congested, and to contain mucoid fluid. As a rule the loop gradually distends, the content becomes muco-purulent, and eventually a perforation occurs, but occasionally the bacteria die off, and the animal remains in good health with a mucocele of the loop (Fig. 2).

2. When the loop is filled moderately full with caecal content, the animal having been fed on a carbohydrate diet (porridge), distension occurs more rapidly with fetid faeculo-purulent fluid, and either an empyema of the loop results or a gangrenous patch develops with perforation.

The latter course is particularly liable to occur if the loop has been almost completely filled with caecal content or if the animal has been on a carbohydrate diet for only one or two days, the latter fact indicating that probably an alteration in the bacterial flora plays an important contributing rôle.

3. With the loop filled with caecal content in an animal previously fed on a rich protein diet (lights) the changes are much more striking and as a rule the animal is dead within twenty hours. On opening the abdomen *post mortem* the loop is seen to be green and gangrenous (Fig. 4), glued to neighbouring coils of intestine by plastic lymph and giving off a faeculent odour. On opening the loop, foul brown fluid content escapes, and this is found to be strongly alkaline in reaction. In an animal killed before this complete sloughing of the wall has had time to occur gangrene is seen to be most advanced in the Peyer's patches. If the loop be only partially filled with content, the changes are slower in developing, but are practically the same.

4. When the loop is filled with an emulsion of bacteria grown aerobically from caecal content no early changes are seen, and if the animal be killed forty-eight hours later the loop presents an almost normal appearance and shows no signs of inflammation or gangrene.

After observing a long series of such experiments one is profoundly impressed with the rapid morbid changes which ensue when faecal matter is locked up in an isolated portion of the intestinal tract. That complete gangrene of such a segment may occur within sixteen hours without there being any interference with the blood supply of the part is a striking fact, which throws considerable light on those cases in which a completely gangrenous appendix is found without there having been any

DESCRIPTION OF COLOURED PLATE.

Fig. 1.—Acute appendicitis; inflammation of the appendicular wall.

Fig. 2.—Isolated loop of ileum of cat; removed by operation three weeks after primary operation. Mucocele of loop.

Fig. 3.—Empyema of loop; three days after isolation; partly filled with caecal content after carbohydrate diet.

Fig. 4.—Gangrene of loop; twenty-four hours after isolation; filled with caecal content, after protein feeding.

Fig. 5.—Mucocele of human appendix.

Fig. 6.—Empyema of human appendix; acute appendicular obstruction, with small amount of faecal content.

Fig. 7.—Gangrene of wall of appendix; acute appendicular obstruction.

FIG. 4.

FIG. 5.

FIG. 3.

FIG. 7.

FIG. 2.

FIG. 1.

FIG. 6.

appreciable disturbance of pulse or temperature.* The importance of anaerobic putrefactive bacteria in such cases has been demonstrated by Heile.

Apparently the two factors determining the degree and the rapidity of the morbid changes in the isolated loop are, first, the amount of faecal matter, and, secondly, its nature as determined by the previous feeding of the animal. If the loop be completely filled with faecal matter at the moment of obstruction, rapid changes, culminating in gangrene, are apt to result no matter what be the nature of the content, though they are more rapid and striking after protein feeding.

When the loop is only partially filled, the changes which follow show more clearly the effects of the nature of the content, those in the protein-fed animals being more of the gangrenous putrefactive type, those in the carbohydrate-fed animals more of the slower empyemic type.

Heile,⁵ in his work on experimental appendicitis in the dog, has reached practically the same conclusions. He found that when the appendix in the dog was occluded, the degree and rapidity of the morbid changes which followed were in direct proportion to the amount of faecal matter present. He was also impressed by the importance of the presence of undigested protein and an alkaline reaction in favouring early necrotic changes, and was able to show that autolysis of the lymphoid tissue of the appendix is greatly hastened by an alkaline reaction of the fluid in which it is placed.

Comparable Conditions in Human Appendix.

In a study of the morbid anatomy of the human appendix we can readily distinguish types of appendicular obstruction strictly comparable to the types of morbid change produced experimentally in the artificially obstructed appendix in the cat.

The hydrops cysticus or mucocele of the appendix represents the result of a complete obstruction of a practically empty appendix, the bacteria having died off and allowed of the development of the quiet mucous cyst (Fig. 5).

In empyema of the appendix (Fig. 6) we see the result of an obstruction to the appendicular lumen when a certain amount of faecal matter, probably not rich in protein, was present. As we know, empyema of the appendix may be fairly acute and rapid or subacute and slow in its development, depending almost certainly on the nature of the faecal content, both as regards chemical and bacteriological constitution and the consequent reaction which it induces.

In those cases of rapid distension and gangrene of the appendix which form so large a percentage of the fatal cases we have the replica of the condition of the artificial appendix filled with caecal content after protein feeding (Fig. 7). In such cases the early changes are: distension of the lumen of the appendix, leucocytic infiltration of the wall followed by gangrene first of the lymphoid tissue and then of the remaining structure of the wall, the whole process, which is of a putrefactive nature, occurring in a space of time to be measured by hours.

I would maintain, therefore, that acute obstruction of the appendix is a pathological and clinical entity, a form of intestinal obstruction, presenting always a grave risk to the life of the individual affected, unless immediate surgical measures are taken for its relief, and that it should be distinguished from acute inflammation of the appendix, not because the treatment of the two conditions should differ, but because the obstructive cases demand treatment before the signs of inflammation supervene. When this distinction is borne in mind it is possible in quite a large percentage of cases to foretell before operation what approximately will be the condition of the appendix. I heartily agree with Battle⁶ that such diagnosis is not mere guesswork and is both interesting and profitable in that it inevitably tends to more accurate observation and hence to increasingly accurate diagnosis.

INCIDENCE OF ACUTE APPENDICULAR DISEASE.

The above observations may possibly throw some light on the incidence of acute appendicular disease.

Race Incidence.

The remarkable frequency of appendicular disease in its acute and fatal form among Western nations and its comparative rarity among Eastern peoples has attracted considerable attention. Lucas-Championnière,⁷ in an analysis of 22,000 patients among Roumanian peasants, found only 1 case of appendicitis. In the cities of Roumania, on the other hand, he found 1 case of appendicitis among every 221 patients. The Roumanian peasants subsist on a diet almost wholly vegetarian, whereas in the cities an animal diet is the rule. Naab⁸ found in three hospitals in Asiatic Turkey, staffed by German surgeons, that operations for appendicitis amounted to only 0.1 per cent. of the total major operations. In Constantinople, at the Turkish hospital, staffed by German surgeons, the ratio of appendix operations was 0.3 per cent., whereas at the German hospital in the European quarter of the same city the ratio was 3.3 per cent. Here difference in climatic conditions could be ruled out, the only difference between the two classes of patients being that those admitted to the Turkish hospital subsisted on a diet mainly of fruit and vegetables, those to the German hospital on a mixed diet with a considerable proportion of animal food. In two large hospitals in Hamburg and Berlin the average ratio was 8.5 per cent. of the total major operations. In Germany, also, it has been repeatedly noted that appendicitis is relatively much more frequently met with among town dwellers than among the peasant class, and that its frequency has notably increased in the last few years coincidently with the increased consumption of meat by the working class. Now whilst one must be very careful in drawing conclusions where accurate statistical evidence is so difficult to obtain, I think all will agree that appendicitis among the working classes in this country has increased of late years, that this is not merely due to greater accuracy in diagnosis, and that this increase has been coincident with the rise of wages and the increasing demand for an animal diet among the industrial class.

Sex Incidence.

All statistics on acute appendicular disease agree in showing that such disease is more frequent in the male than in the female sex, the average ratio being 4 to 3. A fact of greater importance, however, and one not usually recognized, is the greater frequency of the severe and, if not promptly treated, fatal type of such disease in the male as compared with the female. On examining the statistics of the Edinburgh Royal Infirmary for the three years from October, 1910, to September, 1913, I found that during this period 1,469 cases of acute appendicular disease were treated in that institution, the mortality being 7.3 per cent. Of this number, 840 (57 per cent.) were males, 629 (43 per cent.) were females. There were 81 deaths among the male cases (9.6 per cent.), and but 26 among the females (4.1 per cent.). It would thus appear that acute appendicular disease is more than twice as fatal in the male as in the female. On examining the records of the fatal cases one was struck by the great frequency of a particular type of case in the males—namely, that with a completely gangrenous and perforated appendix and diffuse peritonitis; in fact, by the number of cases of what I regard as the most acute form of appendicular obstruction. There are two factors which I think may determine the greater frequency of such disease in the male sex: First, the adolescent and young adult male partakes of a diet which is considerably richer in protein than does the female of corresponding age; and, secondly, he is more exposed to strain and injury, such as might determine the entrance of faecal matter to an appendix with a stenosis or kink near its proximal end.

The mild and usually unrecognized attacks of appendicitis which leave merely scarring and fibrosis in the appendix would appear from *post-mortem* statistics to be very frequent in both sexes of all nations. The urgent gangrenous type of acute appendicular disease which my observations indicate to be of the nature of acute appendicular obstruction is a disease of meat-eating nations, and is more frequent in the male sex. If such be the case, then we are justified in the inference that in a bulky and mainly vegetable diet lies the chief safeguard against acute appendicular disease in its most severe and dangerous forms.

Age Incidence.

The comparative rarity of severe appendicular trouble in children during the first few years of life may possibly be explained by the relatively wide and frequently funnel-shaped aperture of the appendix at this period, allowing of the ready entrance and exit of faecal matter. The corresponding, though less marked, rarity of such trouble in old people is accounted for by the pronounced fibrotic changes so commonly seen in senile appendices, changes which, according to Aschoff,⁹ represent previous mild attacks of inflammation, and which, as a rule, altogether preclude the entrance of faecal matter. In the intervening age period, particularly that earlier part of it which might be termed the period of physical activity and dietary indiscretion, the anatomical condition of the appendix predisposes it to acute morbid changes of both inflammatory and obstructive types.

CONCLUSIONS.

1. Two acute pathological processes are met with in the vermiform appendix—acute appendicitis and acute appendicular obstruction.

2. Clinically acute appendicitis is distinguished by the signs of inflammation, there being from the onset a rise in pulse and temperature.

Acute appendicular obstruction gives rise to vomiting, colicky pain, and abdominal tenderness, but at the outset to no appreciable rise in pulse or temperature.

3. The changes occurring in an appendix the lumen of which is completely obstructed depend on the presence or absence of faecal matter within its lumen.

4. In experimental obstruction in an artificial appendix the changes vary greatly according to the nature of the diet of the animal previous to the experiment, rich protein diet being associated with much more rapidly destructive changes than carbohydrate.

5. Undigested protein, putrefactive bacteria, and an alkaline reaction together produce rapid gangrene in the walls of the obstructed organ.

6. The prevalence of the severer forms of acute appendicular disease in Western as contrasted with Eastern peoples is probably to be explained by the animal diet indulged in by the former.

7. On the same lines may be explained the increasing frequency of such disease in large industrial areas and its relative frequency in the male sex.

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LEECHES :

EXOTIC LEECHES.

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Non missura cutem, nisi plena cruoris, hirudo.

HORACE.

THE extension of war into the Near and Far East has brought into action two genera of leeches which were and still are the cause of extreme inconvenience and even of real danger to troops operating in these areas. The enemies of our allies will still insist on fighting on richly stocked leech grounds. For in the new war area, in southern Europe, Asia Minor, Syria, Egypt and the southern lands of Asia, two genera of leeches which are indeed not the friend but the enemy of man, especially of the soldier, abound.

The first of these two is *Limnatis nilotica* (Sav.), and it is from Savigny that I have stolen the picture of this species. It is a leech of considerable size, attaining a length of 8 to 10 cm., and its outline rather slopes to the anterior end. The dorsal surface is brownish-green with six longitudinal stripes, and the ventral surface is dark. It is a fresh-water leech and it occurs from the Atlantic Islands, the Azores and the Canaries—its western limit—all along the northern edge of Africa until it reaches

Egypt, Palestine, Syria, Armenia, and Turkestan, where it achieves its uttermost eastern boundary. This leech lives in stagnant water; especially does it congregate in drinking-wells—the wells so often mentioned in the New Testament. In the Talmud (Abōdāh Zārāh, 17b) an especial

Fig. 1.—*Limnatis nilotica*, side view. Oral sucker, showing characteristic, median, dorsal slit and three teeth; ventral view. (From Savigny.)

warning is given against drinking water from the rivers or wells or pools for fear of swallowing leeches. The Old Testament Jew knew then nearly as much as we know now about these leeches. They were the cause of endless trouble to Napoleon's soldiers in his Egyptian campaign.

I cannot recall that Napoleon talked much about spreading culture,* but he certainly did it. He took on his incursion into Egypt a score of the ablest men of science he could gather from France. He established in Cairo an "Institut" modelled on that of Paris, and his scientific "corps" produced a series of scientific monographs on Egyptian antiquities and on the modern Natural History of Egypt that has not yet been equalled by any other invading force. He freed the serfs in Germany, he codified the laws of France, and these laws were adopted by large parts of Europe; he extended the use of the decimal system. Napoleon had a constructive policy, and was never a consistent apostle of wanton destruction. If he destroyed it was to build up again, and in many instances he "builed better than he knew." He seldom so mistook his enemies as to destroy, to terrify; the "frightfulness," though bad enough in his times, had limits. Napoleon had at least in him the elements of a sane and commonsense psychology. He knew that what was "frightful" to the French was not necessarily "frightful" to the Russian. Amongst the wonderful series of books and monographs on Egypt which described the varying activities of the savants he took in his train, and who, at the confines of the eighteenth and nineteenth century invaded the country of the Pharaohs, none is more remarkable than Savigny's monograph on the "Natural History" of that country. And in this folio the leech *Limnatis nilotica* was for the first time fully described and depicted.

This particular leech is swallowed by man, by domestic cattle, and doubtless by wild animals, with drinking-water. Amongst the medical writers of the Eastern world in classical times who mention leeches there was always, as there was amongst the authors of the Talmud, a great and haunting fear of leeches being swallowed, and these writers mostly wrote from the area where *Limnatis nilotica* still abounds.

According to Mastermar, who has had, as a medical officer in Palestine, a first-hand opportunity of studying this leech, the pest attaches itself to the mouth or throat or larynx during the process of swallowing, and he is convinced that if it be once really swallowed and thus reaches the stomach it is killed and digested.

Limnatis nilotica, unlike *Hirudo medicinalis*, the medicinal leech, is unable to bite through the outer integument of man and is only able to feed when it has access to the softer mucous membrane of the mouth, of

Fig. 2.—Anterior sucker of *Hirudo medicinalis*. This is to compare with the anterior sucker of *Limnatis nilotica*, which has a characteristic dorsal slit.

* I wonder if it is any use pointing out that the German word *Kultur* is not the equivalent—as our daily Press take it to be—of the English word "culture," brought into fashion forty years ago by Matthew Arnold. *Kultur* = civilization. The German word which we associate with "culture" is "Bildung."