produce simultaneously stimulation and inhibition of intestinal activity. The most effective pair was ergot (stimulant) and calcium chloride (depressant).

When the phenomenon occurs in man the wave is carried with some degree of violence throughout the length of the small intestine. As long as inhibition precedes contraction no harm results, but when the wave reaches the lower end of the ileum, an area in which a new type of nerve supply is encountered, under certain conditions the preceding phase of inhibition is not transmitted, with the result that the strong contraction of the "peristaltic rush" carries a circular area of the gut into the distal segment as an invagination, and the intussusception has begun. I said that the event was likely to occur only under certain conditions, for every child who evidences the "peristaltic rush" does not develop intussusception; a developmental anomaly is the predisposing feature, for, if the ileo-caecal segment has failed to complete its fixation to the posterior abdominal wall, if, in other words, the third stage of intestinal rotation has not been completed, and the ileo-caecal segment is provided with a loose mesenteric attachment, the occurrence of a peristaltic rush is likely to be followed by the development of intussusception. Why this should be is difficult to explain. The laxity of the attachment offers a mechanical explanation of the migration of the intussuscepting segment, but in all likelihood there is a further influence which concerns the nerve supply of the bowel, and it may be the nodal tissue in the ileo-caecal segment.

It is natural that we should inquire about the origin of the peristaltic rush. In view of the experimental work of Snetzler and Auer we are tempted to imagine that some dietetic error which combines the depressant and the stimulant factors may be the source, but, even so, the original stimulus, whatever it may be, is acting upon an intestine which in some way is predisposed to disturbance of this nature, a bowel the functional education of which is not yet adjusted and stabilized.

The period of the intussusceptions is followed by an interval which is largely free from involuntary nerve disturbance of the alimentary tract. It would seem as though the lesson had been learnt, adjustments made when necessary, and the functional education completed.

THE DISORDERS OF ADULT LIFE.

With the passing of puberty, however, or later it may be, in certain individuals there is another breakdown in the neuro-muscular alimentary arrangements, not immediately serious as are the hypertrophies of the early months and the arrhythmias of the early years, yet ultimately of great importance from various points of view, psychological, diagnostic, and toxæmic. The disturbances of these later years are most elusive in both their etiology and their pathology. In view of the time period of their manifestation and the response which many cases show to glandular therapy it may well be that a derangement of the glands of the internal secretories is the origin of the nervous disturbance. From what I have seen I am convinced that an imperfect attachment of the caecum and ascending colon to the posterior abdominal wall is a frequent, in fact I would say a constant, accompaniment of the functional disorders—that, in other words, an abnormal type of intestinal arrangement exists to make such disturbance possible. But we must confess that our knowledge of the etiology remains largely hypothetical.

The pathology is as difficult of demonstration as the etiology. Spasms of achalasia or want of relaxation and atonies express the changes which give rise to symptoms, yet, except in the case of the atonies, many of them are as transient as the morning mist; they vanish during anaesthesia and operation, and when life has fled they too have vanished.

But it is in respect of diagnosis that a great interest lies. During six months' work in the Edinburgh Royal Infirmary I have kept a careful record of fifty-eight cases sent to hospital with the diagnosis of appendicitis. Twenty-four of these showed pathological conditions of the appendix, thirty-four were examples of ileo-caecal pain certainly, but the explanation was not an inflammatory lesion of the appendix, but a spasm of the caecum and the

related colon. There was a diagnostic error which exceeded 50 per cent.

I can produce similar figures in relation to the stomach, where gastric and pyloric spasm and achalasia of the pyloric sphincters have closely simulated stomach and duodenal disease. It is true that many of these disturbances are reflex, and in some instances the association is obvious, but in many it is impossible to discover the source from which the derangement is proceeding. Pain and functional derangements are the usual symptomatic evidences of the spasms and the achalias. Gastric spasm and achalasia of the pylorus may closely simulate the symptomatology of serious stomach disease. I have alluded to the frequency with which ileo-caecal and ileo-colic spasm are confused with appendicitis. I have seen a spasmodic contraction of the colon so closely simulate organic colon obstruction that only a laparotomy made the diagnosis clear. In fact, we can rarely afford to neglect the possibility of a functional disorder of the involuntary nervous system simulating the more serious organic lesion.

The atonies constitute a surgical problem of great difficulty, whether they affect stomach, small intestine, or colon. It is unusual to find associated pain, though a painful spasm may occasionally be superadded to the existing atony. It is rather in the functional derangement that the seriousness lies, for it is inevitable that there is delay in the passage of contents, and the results of toxic absorption are therefore superadded to complicate and obscure the original picture.

It is with a purpose that I have avoided any reference to problems of treatment; it has rather been my intention to present to you a general aspect of the disorders of the involuntary nervous system as met with in the intestinal tract, and to attempt to trace what may be described as an evolutionary picture of disease.

REFERENCE.

¹ Fleiner: *Munch. med. Woch.*, 1910, p. 982.

RADIO-DIATHERMY IN THE TREATMENT OF INOPERABLE MALIGNANT DISEASE OF THE UPPER AIR AND FOOD PASSAGES.*

BY

SIR WILLIAM MILLIGAN, M.D.,

CONSULTING AURIST AND LARYNGOLOGIST TO THE ROYAL INFIRMARY,
MANCHESTER; SURGEON LARYNGOLOGIST TO THE MANCHESTER
RADIUM INSTITUTION.

THE early recognition of malignant disease and its immediate removal by the knife is a counsel of perfection not always attainable. Procrastination is unfortunately inherent in human nature, while other factors, such as fear of operation and the dread of being informed of what actually is wrong, act as deterrents in preventing many patients from seeking advice at that stage when a cancerous growth or ulcer is a strictly localized process and therefore curable.

In my opinion the dissemination of knowledge amongst the public concerning the early symptoms of malignant disease is long overdue, even if it be given at the risk of causing unnecessary alarm to a limited section of the population. The good of the majority should be considered rather than the fears and prejudices of the minority. Educational propaganda would undoubtedly serve a useful purpose, more especially in drawing attention to the possibility of something serious being wrong, and so in gaining that all-important factor—time.

In the fourth quarterly report of the Cancer Survey of San Francisco, Hoffman draws attention to the fact that of 255 deaths of women suffering from cancer of the breast 107 were not operated upon, owing, in all probability, to their having gone to hospital too late, while of 319 deaths from cancer of the uterus 156 were deemed inoperable for similar reasons. The view, so widespread and deep-rooted, that cancer is a disease of later life is mischievous and erroneous, as out of 493 deaths from cancer of the stomach

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among males the youngest occurred at the age of 23, the oldest at 95, and out of the 255 deaths from cancer of the breast the youngest occurred at the age of 27, the oldest at 85.

When, owing to the situation, size, and extent of a malignant growth, surgical proceedings are contraindicated, great relief, and in a certain proportion of cases apparent cure, may be effected by the employment of surgical diathermy, by the use of radium, or by a combination of these two methods—in other words, by radio-diathermy.

The destruction of the local growth or ulcerated area is naturally the first step in treatment, but equally important is the prevention of cell implantation, so common during surgical manipulations, and the sealing up of the lymphatic tributaries which run into neighbouring glands. In diathermy, or, as it is sometimes called, endothermy or "through-heating," we have a method of attack of great practical importance and utility, in effecting as it does the destruction of a malignant growth by coagulation.

Diathermy, like any other therapeutic agent, has its limitations, and is contraindicated in the case of large adherent growths, growths in the intestinal tract, and when there is marked cachexia. The principle underlying treatment by diathermy or "cold cauterization" is that the tissues against which the active electrode is placed resist the entrance of the high frequency current, a current capable of reversing itself from 500,000 to 1,000,000 times per second, with the result that a degree of heat is generated sufficient to cause complete tissue necrosis. Small and accessible growths are in this way readily destroyed, large growths only as the result of repeated applications.

Many years ago Professor d'Arsonval showed that a high frequency current of 3 amperes could be passed through the body with the production of no other sensation than that of heat, while Nagelschmidt turned the "heating through" of the tissues to practical account in both medical and surgical manipulations. The coagulation of the primary growth is attended frequently by great relief, by freedom from pain and haemorrhage, and serves often to prolong the patient's life in comparative comfort.

In many cases it is possible, by means of a block dissection, to remove all infected glands, and by subsequent irradiation to secure the sealing up of the lymphatic tributaries in the dangerous zone, with the result that what was surgically an inoperable growth becomes an operable possibility. The less the biological involvement of the cell the greater its sensibility. Malignant cells, possessing as they do a lower vitality than the normal cells of the body, are comparatively easily destroyed by coagulation, just as they are also by the beta and gamma rays of radium, hence a combination of the two methods is peculiarly valuable when the pathological area is of considerable dimensions. Speaking generally, the depth of tissue coagulated by any single diathermy application is equal to the diameter of the end-piece used, whether disc or button. When, however, applicators having spikes attached are employed, coagulation extends somewhat deeper, more especially if the tissues are kept moist with a 10 per cent. saline solution.

The great advantage of diathermy over electro-cauterization is that in the former the zone of destructive influence is wide, whereas in the latter it is limited by the formation of a carbon core. The type of active electrode used varies with the size and situation of the growth. Button or disc-shaped electrodes are useful where the growth is large and accessible, the needle electrode when it is small, and electrodes with from three to six prongs when it is of the penetrating and infiltrating type. Knife or saw-shaped electrodes are used by some operators when the growth is one suitable for excision. The indifferent electrode should be a plate of metal 6 to 8 inches square covered with a thick towel or twenty layers of lint soaked in 10 per cent. salt solution, and firmly and evenly fixed to the chest wall, the arm, or the leg by means of a bandage.

To ensure the greatest amount of coagulation the active electrode should be applied firmly to the tissues, and applied cold. The current should then be turned on slowly and allowed to attain its maximum intensity (1 to 2 amperes) in the space of from thirty to forty seconds.

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The immediate effect is blanching of the tissues around the terminal, due to the coagulation of their albuminous constituents, followed by bubbles of steam escaping from the burned and now dry area. To obviate steaming and consequent scalding of adjacent tissue the part should be kept moist with saline solution, as when active sparking takes place the diathermy action practically ceases. After the growth has been carefully treated with the active electrode the coagulated tissue should be gently scraped away and the active electrode again applied to the next layer of morbid tissue. In this way the whole growth and the zone of tissue surrounding it is gradually coagulated and got rid of.

The time taken to coagulate and remove a growth will vary with its size and accessibility, but no one application should exceed twenty to twenty-five minutes. The amount of shock following diathermy is practically negligible, and any rise of temperature is seldom more than from one to two degrees, while pain is rarely complained of. The slough resulting from the application takes from ten days to a fortnight to separate, during which time the part should be kept as clean as possible by spraying with hydrogen peroxide. Dusting with powdered charcoal is useful in keeping down the very disagreeable fetor which is so often noticed during the sloughing process.

The effect of diathermy is to sterilize the tissues, and although sepsis may, and does, supervene, it does not do so before a protective barrier has been set up. The resulting scar is soft and pliable and does not form adhesions to surrounding tissues. When coagulation is performed in the neighbourhood of bone, necrosis is practically certain to result, and sequestra may take months to separate.

While the density of the current is sufficient to coagulate fixed tissues and blood circulating in capillaries and small blood vessels, it is quite insufficient to cause coagulation in larger vessels—for example, the lingual artery—with the result that as sloughing takes place subsequently the walls of adjacent blood vessels may give way and severe secondary haemorrhage ensue.

The most brilliant and most lasting results are to be obtained in electro-coagulation of malignant growths or areas of ulceration in the upper pharyngeal cavity—for example, the palate, tonsils, and the base of the tongue. Malignant disease of the palate—from the surgical point of view always very unfavourable—is specially amenable to treatment by the diathermy button, being readily accessible and seldom complicated with glandular involvement. In dealing with such cases free excision or destruction of tissue is essential, regardless of any possible and subsequent deformity.

To estimate the exact extent of infiltration is impossible, and in order to destroy any outposts of disease or, in other words, the zone of attenuated malignancy, it is necessary to coagulate for, if possible, half an inch or thereabout beyond the margins of obvious disease. This often leads to a certain amount of deformity, which later on, however, may be repaired by some form of plastic operation or by the use of some artificial appliance.

The results of electro-coagulation in such cases are frequently brilliant, as is evident from the history of the following case.

H. W., aged 52, consulted his local doctor on account of pain in swallowing, severe and frequently repeated attacks of haemorrhage, and constant pain in his ear. For years he had been a heavy smoker and a heavy drinker of brandy. On examination the left side of the soft palate was seen to be occupied by a large fungating and very vascular ulceration extending beyond the middle line and spreading forwards over the hard palate, with the clinical appearances of an epithelioma, subsequently confirmed by microscopic examination. The affected area was submitted to diathermy treatment and completely removed. Considerable cicatricial contraction resulted, but not sufficient to render the wearing of an obturator necessary. Complete healing took place, with a firm cicatrix. For five and a half years the patient led a normal life; he then again came under observation, complaining of dysphagia. No recurrence of the original disease had taken place, but a new malignant growth was found involving the right arytenoid region and extending along the right aryepiglottic fold.

Cancer of the floor of the mouth is peculiarly amenable to diathermy, care being taken to coagulate freely around the growth until all indurated tissue has been destroyed.

Malignant growths involving the tonsil and palatine

arches and frequently invading the base of the tongue are by no means uncommon, and from the surgical point of view are more frequently inoperable than operable. In such cases there is almost invariably a considerable amount of infiltration and fixation, with extensive glandular involvement in the superior carotid triangle. Owing to the fact that epithelial growths in this situation are very radio-resistant a combination of diathermy and irradiation is useful, the infected glands being first removed after ligature of the external carotid artery, followed ten days to a fortnight afterwards by ligature of the other external carotid artery and coagulation of the primary seat of disease.

Ligature of the external carotid artery is valuable because (1) it makes removal of the glands an almost bloodless operation, and (2) it depletes the primary growth of blood. To obtain free access to the malignant growth and effect complete removal of enlarged glands may necessitate a subperiosteal resection of the angle of the inferior maxilla. By so doing the growth is made accessible, and may be treated from the inside by coagulation and from the outside by irradiation.

If ultimate success is to be obtained it can only be by employing heroic measures. Such cases are surgically inoperable, are invariably complicated with extensive glandular involvement, and even if the primary growth is successfully diathermized the disease will rapidly reappear unless the lymphatic field is thoroughly drenched with the gamma rays of radium.

Irradiation may be effected either by burying needles along the route of the lymphatic stream leading from the focus of disease, by means of applicators applied around the angle of the jaw, or by a combination of both methods. The results are at times surprisingly good, several of the writer's patients having had complete freedom from symptoms for periods of from three to five years.

LARYNGEAL GROWTHS.

Laryngeal cancer fortunately tends to remain localized for a considerable time, and if diagnosed and operated upon at once affords encouraging results. Unfortunately, from one cause or another an early diagnosis is by no means always made, the psychological moment for active intervention passes, and the case is relegated to the arena of the surgically inoperable. This applies especially to cases of extrinsic origin, whose early progress is often unfortunately painless—I say painless advisedly—and symptomless until the presence of enlarged glands in the neck calls attention to something being wrong. In purely intrinsic cases the early loss of voice, hoarseness or huskiness, acts as a most useful danger signal, as glandular involvement is a very late phenomenon, if it occurs at all.

From a surgical point of view the operative treatment of extrinsic laryngeal cancer is often very disappointing, the necessary mutilation of tissue and loss of function being as alarming to the patient as was the original disease.

Access to a laryngeal growth may be obtained *per vias naturales*, with or without the aid of suspension laryngoscopy or after the performance of a laryngo-fissure. The position of the growth, its size and its anatomical relations, help to determine the particular route of approach. I venture to advocate the more frequent performance of a laryngo-fissure, for the reason that so many growths, both extrinsic and intrinsic, are thereby rendered so much more visible than even when approached through the mouth. Certain extrinsic growths—for example, those springing from the sinus pyriformis, the arytenoid region, and the epiglottis—are, however, particularly suitable for suspension approach, more especially if the patient happens to possess a long thin neck and good teeth. A preliminary tracheotomy should be performed whichever method of approach is adopted, as the effect of electro-coagulation is to produce a marked oedema of the loose cellular tissue of the larynx with consequent risk of asphyxiation.

In the event of glandular enlargement being present, the question arises whether the glands or the primary growth should be attacked first. I am of opinion that the glands should be removed in the first instance, after ligature of the external carotid artery, with the proviso that when

glands are fixed and adherent to the deeper structures, carotid artery, jugular vein, and other pre-vertebral structures, operation should not be proceeded with. There is a very distinct limit, often overlooked, to what electro-coagulation and radium treatment is capable of accomplishing, and these limitations should be recognized. Where glands are, however, non-adherent and can be removed, the lymphatic avenues leading to them should be thoroughly irradiated after coagulation of the primary growth. This is best effected by the insertion of from six to eight tubes, containing from 5 to 10 mg. of radium, along the course of the lymphatic stream. I am now fully persuaded that better results are obtained by implanting radium needles within the tissues than by applying applicators on the surface, the number of milligram hours varying with the extent of the existing disease.

When, however, it is decided to rely on radium alone, a useful plan is to resect a portion or the whole of the thyroid ala and through the fenestration to insert with precision into the growth a varying number of tubes and subsequently to fix a casted radium applicator round the neck.

MALIGNANT GROWTHS OF THE ANTRUM AND ETHMOIDAL LABYRINTH.

The malignancy of antral and ethmoidal growths varies enormously, some running a very virulent course, others, although pathologically malignant, being clinically almost benign. The lymphatic tributaries leading from the antro-ethmoidal region run to the submastoid and carotid glands, which, at a late stage, tend to become much enlarged. In the event of the disease being so advanced as to preclude the advisability of a resection of the upper jaw or its removal by means of a lateral rhinotomy, it may be coagulated and irradiated after exposure. Exposure of the growth is advisable to facilitate the free application of the active electrode, and to minimize subsequent necrosis.

After resection of the anterior wall of the maxillary sinus or opening up of the ethmoidal labyrinth, as much as possible of the growth should be removed with a curette and the cavity thoroughly diathermized with a button or disc-shaped electrode. The application of radium with the aid of a face-mask should subsequently be undertaken. The steps taken in such an operation are therefore as follows:

1. Ligature of external carotid artery.
2. Removal of glands.
3. Exposure of antral or ethmoidal growth by external incision.
4. Curetting of growth.
5. Application of button electrode.
6. Surface application of radium.

Frequent inspection of the cavity should be made after operation in order to detect and to coagulate any suspicious areas.

NASOPHARYNGEAL CARCINOMA.

Malignant growths in the nasopharynx present another problem of great perplexity. Sarcomatous growths yield fairly readily to treatment by means of radium alone, the number of needles and the dosage employed varying with the size and structure of the tumour, whether round-celled or spindle-celled.

True carcinomata—spheroidal-celled, columnar-celled, or epitheliomatous—are unfortunately not so satisfactory, largely owing to the difficulties of adequate approach. Division of the soft palate with removal of a portion of the hard palate, or the slinging forward of the soft palate with rubber bands helps to expose the growth to view, and to make the application of a button or pronged electrode fairly satisfactory. There should be no hesitation in freely removing any tissue, hard or soft, in order to gain proper access to the growth. Several applications may be necessary to coagulate even a small growth owing to the mechanical difficulties involved.

Nasopharyngeal fibromata or fibrosarcomata respond well to coagulation, which probably affords the least dangerous method of attack.

ESOPHAGEAL CARCINOMA.

Of all organs in the body the most disappointing, from the surgical point of view, is probably the oesophagus. The absence of a serous coat combined with a flabby and

lax musculature renders it peculiarly unsuitable for operative procedures. Moreover, the risk of rupture of its walls from ulceration or instrumentation must not be ignored.

Cancer of the hypopharynx—in females a by no means uncommon affection—is amenable to diathermy provided the disease is high up and strictly localized, which it rarely is, however. In such cases the growth may be rendered visible with Seiffert's directoscope.

Access to a malignant growth in the oesophagus situated about the level of the bifurcation of the trachea—a common situation—or at the cardia, is naturally difficult, but is possible with the aid of the oesophagoscope. In this situation diathermy is, however, always dangerous owing to the difficulty of ascertaining the degree of mural involvement and the risks of perforation. In every case an attempt should be made to determine the extent of the tumour. This may be done by the method of "coulée reversée," the patient lying in a reclining position with the head lowermost, thus permitting the opaque meal to run backwards and so to outline the lower edge of the growth. An active electrode is then passed and the growth carefully coagulated. The electrode recently designed by Wright of Bristol renders the application of diathermy easier and safer than with any other, since it coagulates from below upwards, and therefore under the observation of the operator, instead of, as is usual with other instruments, from above downwards. If it is desired to irradiate with radium, an endless thread, to which one, two, or three screened tubes containing radium element are attached, is swallowed and the tubes pulled into position in vertical series. The preliminary coagulation and consequent opening up of the stricture will be found to permit of this being done comparatively easily. In two of my cases a lumen sufficient to enable solid food to be swallowed was obtained, while in another case coagulation of the growth was followed by complete cicatricial atresia. In all cases the performance of a preliminary gastrostomy is advisable.

Whether it will ever be possible to excise a malignant growth of the thoracic oesophagus after the performance of a thoracotomy is in the lap of the gods. At the moment diathermic coagulation, with or without the subsequent employment of radium, affords a chance, although a very slight one, of eradicating the disease.

The early and more frequent use of the oesophagoscope in all cases with symptoms of even slight dysphagia should be impressed upon the profession as the one and only means of arriving at an exact diagnosis.

Summary of the Advantages of Diathermy.

1. That it is of definite value when ordinary surgical procedures are contraindicated.
2. That it is followed by little, if any, shock.
3. That with reasonable care it is a practically bloodless operation.
4. That besides sterilizing the tissues it blocks the vascular and lymphatic channels leading to and from the growth.
5. That by so doing it tends to prevent dissemination of the cancer cell.
6. That it affords relief from mechanical symptoms such as obstruction, dyspnoea, etc.
7. That it arrests the tendency to spontaneous haemorrhage.
8. That it relieves pain.
9. That the resulting scar tissue is soft and pliable and does not form adhesions.
10. That septic bronchopneumonia is less frequent than after severe cutting operations.

Disadvantages of Diathermy.

1. That it destroys a certain area of healthy tissue around the original growth.
2. That the walls of blood vessels in the immediate neighbourhood of the growth may become softened and ulcerated, with resulting attacks of severe secondary haemorrhage.
3. That when the skin is involved keloid cicatrices may develop.

The advantage of combining the application of radium with coagulation by diathermy is that the lymphatic area is thereby irradiated, wandering malignant cells are killed off, and the risk of subsequent metastasis is materially lessened.

The results obtained by radio-diathermy, complicated and tedious as the treatment undoubtedly is, will repay all the trouble taken, the patient frequently taking on a new lease of life, free from pain and haemorrhage, and in most instances ending it with greater comfort than would otherwise have been the case.

ON THE ACTION OF CERTAIN ALLEGED INTESTINAL ANTISEPTICS.

BY

LAWRENCE P. GARROD, M.B., M.R.C.P.,
DEMONSTRATOR OF PATHOLOGY, ST. BARTHOLOMEW'S HOSPITAL.

THERE are on the market several preparations described as "intestinal antiseptics." To my mind the meaning of the advertisements can only be that the preparations are capable, when taken by the mouth, of destroying at least a proportion of the organisms in the intestinal tract. The total extent of that effect, and its degree in the case of each different type of organism present in the bowel, are not described; it may, in fact, be said that the claims made for these products are, with one exception, unsupported by any evidence, generally known, of their action in the human subject.

The flora of the bowel undergoes very radical changes between the jejunum, where organisms are first found in any considerable numbers, and the rectum.¹ The organisms found in the former situation disappear even before the ileo-caecal valve is reached, and those present in the faeces make their first appearance certainly no higher than the middle of the jejunum. What the action of an alleged intestinal antiseptic may be on the organisms in the upper part of the intestinal tract is almost impossible to ascertain, and the following observations are concerned only with those present in the faeces. These, or certain of them, are the organisms which it is regarded as desirable to destroy when an intestinal antiseptic is employed, and they are those which these drugs are generally understood to be capable of destroying.

The enumeration of living aerobic organisms in the faeces is not a difficult matter. To enumerate living anaerobes with accuracy is almost impossible, and these have therefore to be left out of account, it being assumed that the numbers of coliform bacilli and Gram-positive cocci obtained in aerobic cultures are a sufficient index to the total numbers of living organisms of all kinds in the specimen. Certain factors have, however, to be taken into account which render such an investigation less simple than would at first appear. Of these the principal is that wide variations may occur from day to day in the total numbers of living organisms in the faeces. A fluid stool may contain one hundred times as many living organisms as a scybalous stool from the same subject. It is therefore desirable that the subject of an experiment with one of these drugs should be accustomed to passing daily stools of reasonably uniform character, and further, that the observations should be continued over a considerable period, in order to obtain a reliable average. It is necessary, also, to cultivate the specimen within a few hours of its being passed, or to keep it in the cold, since rapid multiplication of the organisms contained in it will occur at room temperature. Lastly, in view of the well established effect of diet on the bacteriology of the faeces, it is desirable that the subject should remain on a fairly consistent diet throughout the experiment. These precautions were observed in the investigations to be described. The method employed was the following:

Method of Investigation.

About half a gram of faeces is placed in a large sterile tube of known weight and accurately weighed. Sufficient sterile water is added to give a convenient dilution, such as 1 in 50. Complete emulsification is carried out by forcing the fluid in and out of a long syringe with a wide-bore needle (this process will do in