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Examination for the Degree of M.D.

Theory

Epidemic Diarrhoea — Consideration of the Etiology and Treatment

by

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Epidemic Diarrhoea. Consideration of Its Etiology and Treatment.

In attempting to outline the subject of Epidemic Diarrhoea, I recognise the difficulty of separating the group, which we are accustomed to call by that name from the other forms apparently so closely related to it, that by a large number of practitioners they are registered as the same disease. It is certainly much more common among children than adults, but occurs in the latter class to a very large extent when dietetic circumstances for them approach, at times, the conditions in which the great majority of children are placed. For that reason, though it must be discussed to a great extent as a children's disease, it is well in the first place to recognise that the Synonym, Infantile Diarrhoea or Epidemic Infantile Diarrhoea, is incorrect and misleading. Again, it seems to me confusing and incorrect to separate and name them as separate entities—Cholera Infantum and Acute Entero-Colitis unless indeed the latter is specifically mentioned, as a complication of another disease. The evidence which we now have about the pathology of Diarrhoeal Diseases, being gathered from the results of post mortem examination.

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tions, and from the examination of diarrhoeal stools, is in favour of regarding Cholera Infantum and Cholera Nostra, as well the less acute forms of diarrhoea so long as they are accompanied by constitutional disturbance, as all being the result of organic irritation of the gastro intestinal tract. The causative agents may under suitable conditions produce the disease in epidemic form, and enterocolitis may at any time be present accompanied or not by gastritis, the changes in the gastric and intestinal walls depending upon the intensity and virulence of the infection, and the length of time it remains in the tract.

Entero colitis may certainly exist and be the cause of a diarrhoea similar in appearance to that which is the result of the ingestion of organisms or their products, but in these cases it is a pathological condition complicating another disease such as pneumonia or an acute specific fever, or possibly, as has been asserted, exists as a catarrh from chill. It cannot however be separated from the symptom group called Cholera Infantum, for in the condition which the latter shows to exist in an extreme degree,
Entero Colitis is very commonly present and additional symptoms are introduced as it becomes pronounced. Indeed to classify the disease in this way, is avoiding the adoption of an Eteological, a Clinical or a Pathological basis, and on the other hand naming separately the Pathological condition, which underlies most of the forms, as one variety of diarrhoea and the Clinical evidence of a certain stage in that Pathological condition as another variety. In Epidemic diarrhoea (with which Cholera Infantum must be classed,) Klein points out that "generally there was more or less inflammatory thickening of the mucosa, and even in a case of only a few hours duration, denudation of the epithelium, both of stomach and intestine". Though the poisons taken into the Gastro Intestinal tract with milk, and other articles of food which have been acted upon by organisms, may directly induce a profuse secretion from the glandular structures in the walls of stomach and bowels, and a violent reflex or direct peristalsis, by their irritating effect, they also bring about structural changes varying from Hyperaemia to the most intense follicular ulceration, and the stools are very often
seen to contain much mucus or blood. It does not seem that the Entero Colitis differs in any way, when it is the result of agents which may simultaneously affect a great number of individuals, from that inflammatory condition which is caused by other agencies such as cold, acute general diseases, or ingestion of non-organic poisons, or in some cases of unsuitable food. Indeed, it will be seen, that organisms which are found in the stools of patients suffering from Choleraic Diarrhoea, organisms, which are affirmed to bear a direct relation to that intense form of the disease, have been found also in the stools of patients suffering from what would be described as Entero Colitis; and the Entero Colitis occurred in epidemic form following the ingestion of certain milk food. And in some cases at least, of what are called Acute Dyspeptic Diarrhoeas, the organisms to which I have referred viz Bacilli Enteridis Sporogenes, have been found. These have been found in the food supplied to the patients, and the same organisms on separation from the stools have brought about certain typical re-actions when cultivated in milk, and when injected into the groin of a guinea pig. I have not however had an opportunity
of seeing the result of readministration from the culture.

We may have a Diarrhoea in children without Catarrh but simply as a result of irritation from contact of an undigested portion of curd or other food with the mucus membrane of a sensitive individual. This likewise is a common cause of increased peristalsis in adults of a nervous or hysterical temperament. It is not attended with any constitutional disturbance except restlessness and perhaps colicky pains, and is only an exaggeration of a natural physiological process. It is a functional disturbance and may be unattended by any change whatever in the bowel. Its counterpart in the stomach is the regurgitation or vomiting of milk to which so many infants are liable during the first few months of life.

A diarrhoea very closely allied to this form may be brought about by unsuitable food administered to a child, or food in excessive quantity. Here functional disturbances may be accompanied by an excessive hyperaemia of the Mucosa, and Catarrh may follow with the constitutional disturbance which depends upon that lesion - more frequent and offensive motions
excessive flatus and undigested food, mucus and epithelial cells. Fever is generally present and the patient is ill and miserable.

Entero-Colitis is very liable to follow such an attack of Enteric Catarrh and this name seems to be reserved for a more severe and deep-seated inflammation of the Intestinal wall. The mucous membrane of the upper part of the small intestine is thicker and more highly vascular than that of the lower end, and though this extremely well nourished part may be affected, the chief brunt of the disease falls upon the Ileum and Colon. The lymph follicles become congested, hyperplastic, and project from the surface; then ulceration of these takes place. The fever is higher and the stools contain mucus and blood in a marked degree so that they are often called Dysenteric. The disease may be very acute and is one of the common causes of Infantile convulsions, by which the child may be carried off; or it may merge into a chronic disorder. Many varieties and degrees of the affection exist and it may be very gradual in its incidence or come on with great suddenness and severity. (A very chronic and distinctive form of Inflammation which may be accompan-
ied by ulceration of the intestinal wall has been called the Coelive Affection. I have mentioned the different grades of Catarrh and Follicular Enteritis as being the result of dietary faults or indiscretions, and have so far regarded them as caused by food which the natural processes of digestion have failed to convert to a condition suitable for absorption. The changes in the food which may be produced before its administration, or while it is in the stomach and intestine by foreign agents may bring about a similar result and in many cases the substances produced by those changes are the cause of the most intense and rapid forms of Diarrhoea.

Before coming to that particular cause, we may mention other agents the recognition of which give the clue to the symptoms and anatomical changes they produce.

A chill or cold may generally be recognised by the history and the feelings which preceded the Diarrhoea and Intestinal pains. A catarrh of the Intestines from this cause is not infrequent and Burney Yeo quotes Leube's reason "that it is due to driving the suddenly cooled blood from the surface of the body into the intestines, where the
irritation excites increased peristalsis and inflammation, "but he himself suggests that the catarrh so caused is dependent on a reflex vaso motor influence arising through the cutaneous nerves, or is dependent upon arrested cutaneous secretion causing a retention in the blood of substances irritating to the Intestinal Mucus Membrane, in a manner analogous to the development of duodenal inflammation following a burn.

Diarrhoea may follow General Diseases, Venous obstruction in the intestinal tract, and often is present in certain blood conditions among which may be included Uraemia. The allied conditions are very evident, or can at least be detected by examination.

Epidemic Diarrhoea or Epidemic Enteritis, as it is now called, stands apart from other forms of intestinal trouble which we have named, and with which it might be confused, by the fact that it occurs most conspicuously and in the great majority of its victims at a certain season of the year. So well is this recognised, that it is the very cause of overlooking what is very probable, and almost beyond doubt, viz. that many of the cases of Diarrhoea which occur during seasons of the year other than
the third quarter are due to the same agencies that produce the Disease in Epidemic form. This form of the disease must certainly be caused by organisms and their products, for though the results of investigation, to determine particular forms as being the "unconditional, invariable antecedents", and therefore direct evidence of this theory, - have been much disputed, there exists circumstantial evidence from a Public Health point of view, which is in itself almost conclusive. That evidence it is well to look at first, as it bears so strongly upon the conditions, favourable for the existence and vitality of micro-organisms, and channels of communication with the system. One meets the names of Booker and Jeffreys, Klein and Baginsky and many others as having tried to establish definite organisms which should prove to be the sole and only cause of the disease, wherever it appears, and the "unconditional, invariable antecedent". If this has not been done, their work has gone to prove that many different organisms found in the stools do each and individually produce a poison which may cause Diarrhoea and produce changes in the walls of the Gastro Intestinal tract, if a large enough quantity
be ingested. Many of these may be found in the stools of the same individual or in the milk or food, which may have been administered to that individual, and there is no doubt that they very often act in combination. Different grades of the Disease, cases of varying acuteness or virulence, and those in which the intestine alone may be affected or the intestine and stomach together, it is possible, may be caused by varying largeness of the dose or the higher toxic producing properties of certain species present. Few cases indeed are of that intense virulence which in children and adults is evidenced by profuse Diarrhoea vomiting and collapse and is known as Cholera Infantum and Cholera Nostras. Ostler says that this form according to Holt occurs in only two or three per cent of the cases of summer diarrhoea. The great majority though still severe are less acute or, it may be, subacute, but the number of deaths is collectively larger though relatively of course they are not so. In the less acute cases which are as much due to organisms and perhaps to the same organisms as the severe ones there are generally inflammatory processes such as Catarrh and even ulceration of the lymph follicles, and the stools bear evidence of the
intestinal lesion by the presence of Mucus and blood. In the Choleraic form, when death results early there may be comparatively little change in the intestine, perhaps only an anaemic and softened condition of the Mucous membrane, with shedding of the superficial epithelium. Taking it as proved that certain

Vaughan poisons produced by Bacteria are the cause of the disease, the rapidity of development, and the acuteness of the symptoms will depend upon the preponderance of the more virulent species at work, and whether the organisms are at work only in the intestinal contents or have been at work before the food containing them has been ingested. If the poisons are produced in the intestines alone the development of the symptoms will be less sudden, and these will increase in gravity with the time allowed for the Bacteria to elaborate toxic substances, and pari passu, for the latter to be in part absorbed and in part to act upon the walls. On the other hand if the food has for a time, already been acted upon, there may be enough poison in what is administered to develop the symptoms with great rapidity, and a condition of collapse may appear almost as quickly as in profuse haemorrhage, or in trauma. Vaughan says that the mere in-
Epidemic Diarrhoea

Injection of poisons, separated from cultures of the organisms and suspended in water, will bring about the usual bowel symptoms if the animal live long enough; and the Post Mortem appearances are: a Pale contracted Intestine, containing Mucus of a frothy nature, the Stomach is distended with gas and containing bile stained mucus. The Heart is distended and the spleen and kidneys are congested.

Whatever organism or organisms are present in Epidemic Diarrhoea, there are other conditions which have a large influence in establishing its annual incidence and retarding the efforts made for its total extinction. The earnest and unremitting efforts of Public Health Authorities are directed towards the elimination of those accessory factors so far as they can be submitted to human control.

The season of the year in which the disease becomes widespread, and during which alone it can be characterised as existing in Epidemic form is the 3rd quarter. Ostler says that the mortality curve "begins to rise in May, increases in June, reaches the maximum in July, and gradually sinks through August and September"; and that we cannot regard the heat itself as the direct agent but only as one of the fac-
tors, since Siebert, from an analysis of the mortality and temperature, month by month for ten years in New York, failed to find a constant relation between the degree of heat and the number of cases of Diarrhoea; and that neither Barometric pressure nor humidity appear to have any influence. That these factors, temperature and humidity have a marked influence, but may antagonise one another or be affected by other influences in certain regions, is a very important consideration, which will be referred to when we discuss the individual factors. The third quarter of the year is the season in which above all others we most consistently have a temperature sustained for a period sufficiently long to affect the soil and water and raise these, especially the former to a definite temperature, capable of resuscitating organisms which we must acknowledge were present but which have been lying dormant. The influence which is exerted so markedly at this season, is not limited to it alone but extends into other quarters of the year in a lesser degree. Again, this seasonal influence is not the same in all towns for while in all there is a high proportion of Deaths in the 3rd quarter over the 1st 2nd and 4th the ratio in different towns varies markedly. To illustrate this -
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<td>Preston</td>
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<td>Brighton</td>
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Thus in Preston the proportional deaths of the three quarters, other than the 3rd, is just about double that of Brighton. To take a more pronounced instance the difference between the mortality of the 1st quarter and the 3rd quarter is in Brighton as 1: 24.1 while for the same periods in Glasgow it is as 1: 4.2 only. While the Diarrhoea has the character of an Endemic Disease in Glasgow, Preston and other towns which I have alone quoted, in many it more nearly approaches the character of an Epidemic Disease, reappearing in greater or less degree at its proper season while the amount in other seasons is comparatively insignificant. Still that insignificant quantity is present, occurring as sporadic cases during every month of the year, and from such as are truly this affection the same organisms may be isolated as from the cases in the
height of an epidemic. For an epidemic to develop we require the accessory factors High Temperature and Deficient rainfall to produce a certain effect upon the soil and the organic life which it conceals and supplies with pabulum.

Temperature and Rainfall. The mortality of Infantile Diarrhoea, and the number of cases, at all ages rises in direct proportion to the temperature and the lack of rain, if we take towns having equal social and sanitary standards and if we allow for exceptions which are explained by their sanitary history. The high temperature aids in producing this disease just as it aids in the growth of vegetation. The organisms which are necessary for its production require a certain temperature for their pathogenic existence so far as it comes under our observation. They become very numerous widespread and virulent when the temperature of the atmosphere and the sun’s rays have been able to raise the subsoil to a depth of 4 inches to 60°, and towards July this generally takes place. Sporadic cases occur at other seasons of the year probably by a limited number being revivified and raised into pathogenic activity, owing to favourable
local circumstances, and it is a notable fact, that the proportion of cases increases as we approach the warmer weather; e.g. in the second quarter as the cold weather is being left behind and during which we have periodic intervals of high temperature, though these may be and generally are, followed by cold spells. Again the fourth quarter is next in mortality to the third, and this may well be owing to the legacy of heat which the soil retains from the superabundance bestowed upon it during the third quarter and which has penetrated to a considerable depth.

By some authorities deficient rainfall is looked upon as a greater factor than high temperature in bringing about the prevalence of the disease, and this has been based upon statistics which it was thought would allow each factor to be studied separately. The precise reason of this influence is difficult to define for most organisms require moisture as well as heat to have a favourable field for multiplication and development. Much depends upon the flushing of the surface and scavenging and cleaning of the air and it is a matter of well attested ex-
perience that there is a much greater benefit derived from the rainfall where the slope is great, and the surface drainage efficient, than in low-lying and badly drained areas. In fact, after a mild rain when the air and soil have been made humid and when the heat has again become intense, one finds that the number of cases of diarrhoea is greatly increased and the mortality is then highest. No doubt much of the benefit which results from a prolonged and heavy rainfall is due to the cooling influence upon the air, and especially upon the soil, and the removal of the bacteria or spore-laden dust, which is a principal means of carrying infection over a wide area. Dr. Johnston, M.O.H. of Leicester looked upon the disease as one which would be non-existent (and by that I suppose he means in epidemic form) "in any town or district whose sanitary machinery was perfect and in good working order" and that the vicissitudes of climate would there be found to be perfectly harmless in the production of the disease. But under existing circumstances a continuance for a week or ten days of a mean daily temperature of 59°F (?) or over, in conjunction with a scarcity of rainfall and a low degree of humidity of the air occurring during
a period from the 25th to the 27th week is sufficient either to provoke the disease or to increase its prevalence. The evidence of statistics, is in favour of the deduction, "that whether the records of the 3rd quarter or of the entire year be taken, those towns with the lowest temperature and the greatest rainfall have the lowest mortality and vice versa, with certain exceptions which might be otherwise explained." Preston with a lower earth temperature than either Portsmouth or Brighton has an immensely higher mortality than either, but it is at a disadvantage to both those towns in one important particular viz. that its closet system consists of middens in 3 parts and water closets in only 1, whereas both Brighton and Portsmouth have water closets each in toto. Brighton, also, has a steep gradient for a surface whereas Preston is flat, and consequently the advantage which the latter might derive from its lower temperature is more than counterbalanced by the contamination to which its soil is exposed, and its defective surface drainage.

It follows from what has been said regarding rainfall and temperature, that these almost inseparable
agents for (in this connection) good or evil respectively, depend for their important influence, on air and soil especially the latter. And again, bound up with the question of soil is that of Sewage systems existing in different districts, for those poisonous agents which the soil contains are derived from that source either directly, or indirectly, as in the overflow of a polluted river. Further the sewage material forms pabulum upon which organisms will thrive, when other conditions favourable to their active existence set in. Dr. Ballard in his report laid down, that "Where the dwelling houses of a place have as their foundation solid rock with little or no superincumbent loose material, the diarrheal mortality is notwithstanding many other unfavourable conditions and surroundings, low, and on the other hand a loose soil, is a soil on which diarrheal mortality is apt to be high. And the reason of this is very plain for it is evident that a porous soil will be easily contaminated by discharges thrown upon the superficial soil or leakage from faulty drain pipes, cesspools, or privy middens". During two seasons — separated by an interval of three years — I was struck by the immense number of cases and the high mortality from Epi-
emic Diarrhoea in a district which still has as its principal sewage system - cesspools - and the more so, as I had an opportunity of comparing it with other towns of a similar social status at the same time of year. From the gentlemen whose practices I refer to, I learned that my experience was not exceptional nor due to an accidental rise or fall in the number of cases, nor could I find that it was due to greater neglect of personal hygiene in the one case than in the other. Dr. Ballard further says in his report: "That though it be a rocky town if the rock contain fissures into which organic matter has permeated the same result may be seen in the health of such neighbourhods. That it is by its influence on the soil that rain produces its ameliorating or preventative influence in Diarrhoea, since protracted or heavy rainfall prevents the rise of temperature to 56°. As the result of many experiments he found that the height of the summer rise of Diarrhoeal mortality was not great till the earth temperature was 56°F at four feet no matter what the temperature of atmosphere or even of earth with the one foot thermometer should be. We may agree with the statement that given care in scavenging, adopting all the best arti-
ficial methods both for the prevention, and the removal of organic pollution of the air and soil, in different towns we should expect that the most porous soils would have the most diarrhoea. But it is important to qualify this statement, for, from the evidence of statistics, there are notable exceptions and these must be explained by the past sanitary history of a town or district and the influence on the soil of a former defective scavenging, being prolonged after the faulty system has been removed. Liverpool and Leicester are notable exceptions to the rule, but in these towns there was a regular and widespread pollution of the soil and till that polluted soil be purged of its impurity the effects may remain, even though further addition to its impurity should now be absolutely prevented. In Liverpool this is not the case for there are still trough closets in a limited number of dwellings. Liverpool has shown practically no improvement so far while Leicester has slightly improved its Infantile Diarrhoeal mortality since the adoption of the water carriage system. The means best calculated to prevent pollution of Porous soil where it exists, is to have a good water-carriage system of drainage and where
water is abundant and convenient, to utterly abolish all other systems of removing excrement. It is a matter of experience that towns have a much lower diarrhoea mortality under the former system than under the latter, though in certain parts of the country the latter is prevalent, owing to considerations outside the jurisdiction of Public Health Officers. It actually happened in Manchester during the past summer that a proposal was made to substitute another system in portions of the town, in place of the water carriage system, owing to a water famine, and this in spite of the fact that that city has an area of supply which can give abundance, and is only prevented from doing so, by a temporary deficiency in the means of transit. Though several towns with a low mortality have still pail closets, such as Halifax and Oldham, they have other advantages which outweigh this disadvantage, and if that were removed it is possible they might also improve. As bearing on the question of drainage and its effect upon the soil I quote an instance which occurs in a report by Dr. Tomkins, Medical Officer of Health for Leicester, which was published in 1888.
ter had long been a subject of interest in connection with Epidemic Diarrhoea, and is so still but it has now improved probably due to the better system of drainage, established since the time of the report I mention. During the summer of 1887 Dr. Tomkins conducted experiments (which only formed part of the much more extended inquiry which was going on for Dr. Ballards report not then published) to determine the number of micro organisms and their spores in the air of different parts of the town and he found them varying in number from 1600 to 6000 per cubic metre. The former came from a part outside the area in which Diarrhoea was prevalent - the latter from the Diarrhoea area. Cultivation also revealed the fact that the different forms of Bacteria and other organisms were much more numerous and varied in the infected part of the town than outside it, and as a matter of fact this was the part of the town which habitually returned the greatest number of Diarrhoea cases, when the epidemic appeared. It was also ascertained that exceedingly small quantities of the liquefied gelatine, which resulted from the cultivation, and which swarmed with the organisms in question, sufficed when taken into
the system, to induce a smart attack of Diarrhoea lasting a few hours. Leicester had not always suffered as it had come to do at that time, but an examination of vital statistics shewed that it was not till about the year 1850 that the deaths in the third quarter became excessive. About 1851 evidence became apparent as to filthiness of soil in certain parts of the town, and the knowledge of the geological circumstances proved that the soil of a large area of the town, though continually liable to pollution had scarcely any chance of purification, and that periodical flooding of the river and overflow, with leakage from sewers, had sufficed to keep it more or less constantly contaminated and in fact sewage-sodden. Such a soil containing as it did much dead organic matter was when heated precisely such as to favour the growth and development of low organic life. It was regarded at that time as abundantly proved, both by a process of exclusion, and by positive evidence, that the Epidemic Diarrhoea was due to something in the air and soil, that this something was organic life and products; and that these had been cultivated and experimented upon. It was not attempted to differentiate the organisms one from the other or to tell which
were pathogenic and which harmless. It is now known that many of them, from experiments by Klein and others, are specific in their action but it is difficult to say that others are not so, and probably not one alone, but any one of several, or several acting in co-operation may bring about the disease. Dr. Ballard's conclusions as to the connection of the soil and organisms contained in it set out provisionally were "That the essential cause of Diarrhoea resides ordinarily in the superficial layers of earth, where it is intimately associated with the life processes of some micro organisms, not yet detected or isolated. That the vital manifestations of such organisms are dependent among other things perhaps principally upon conditions of season and on the presence of dead organic matter which is its pabulum. That on occasion such micro-organisms are capable of getting abroad from their habitat the earth, and, becoming air-borne, obtain an opportunity for fastening upon other non-living organic materials, and for using such organic material as both nidus and pabulum, while undergoing various phases of their life history. That in food both inside and outside the human body, such organisms find,
especially at certain seasons both nidus and pabulum convenient for their development, multiplication and evolution. That from food, as also from the contained organic matter of certain soils, such microorganisms can manufacture by chemical changes wrought therein, through certain of their life processes, a substance which is a virulent chemical poison and that this chemical substance is in the human body the cause of Diarrhoea, when it occurs in Epidemic form.

Epidemic Diarrhoea as a fatal disease has been said to be a disease of the artisan and still more of the lower labouring classes to a preponderant extent. This is only another way of saying that where there is less opportunity or less energy in guarding the child's life and health, the disease prevails more extensively. If we are satisfied that the disease is always and invariably contracted by ingestion of the organisms and their products, this will be a self-evident fact, and it appears so to us, not because the mother, in this class of the population is less anxious about her child's health. In proportion, and excepting almost this one disease,
it seems almost the opposite. But about no disease, and regarding the measures to be observed for the prevention of any disease, is there such gross and widespread ignorance found to prevail, and this unfortunately reaches its full development in the class, whose circumstances render lack of cleanliness less repugnant to comfort, in some cases apparently a necessity for comfort. Unfortunately also and I suggest it in a diffident spirit, the physician does not take so much trouble to point out, and explain the essential and important, if simple rules to be observed, to this class, as he does or has to do to the class of mothers who show an intelligent and even eager interest in the causes at work to produce the issue. That this is true one is forced to believe from the disappointing incredulity on the one hand, and the statements of their source of knowledge on the other, and when one finds the same conditions regarding such knowledge to prevail over a number of varying classes of practice. Apart from the wilful neglect of children, and absolute and sinful neglect of the cleanliness of vessels, and suitability of food, which of course exist in a number of homes, this ignorance we have spoken of
and in addition the manifold duties which fall to the lot of a woman whose children are numerous and whose means are narrowly limited, make it easy to understand that the infant will have less protecting influences around it, and consequently a greater number will suffer, and from a similar cause will have a more violent attack of the disease. In many towns it is to be remembered, the mothers in the homes of the working classes go out to work, and consequently her children are farmed out for the day or at least left in the care of persons of less responsibility than herself. It is difficult to credit apart from experience to what an extent this practice is carried on in certain parts of the country, but in the manufacturing towns of Lancashire the women both married and single take an equal part with the men in wage-earning. Among the poor also, other disadvantages to children are very evident. When the child is not breast-fed, there is less room and consequently it is more trouble (a most important consideration) to preserve and store the milk secure from contamination. When it is desirable to use more expensive artificially prepared milks - such as humanised - it is obviously
ludicrous to suggest it to people with small means, and what is prepared at home, is often done most inadequately.

It is a disease, more especially of towns as is abundantly proved by statistics and experience. If the air and soil be polluted, that pollution must almost certainly be much more concentrated when we have large aggregations of the population with the possibilities which that offers. Another disadvantage connected with Urban life is that milk, the great food supply of children, has a longer transit from its source to the consumer, and more chance of contamination on the way.

All these Factors which we have named are most important from a Public Health point of view and if the faults which are evident and which are removable could be abolished, Epidemic Diarrhoea would be much less formidable and of infinitely less proportions even when the heat became excessive. It is obvious that nothing can be done nor is it desirable, to arrest the natural forces which come into play in the causation of the disease. Heat exercises its beneficent influence upon all vegetation alike, causing the weeds to grow if their seeds have been sewn
and counteract the good influence which it, at the same time, is conferring upon useful plants. It fosters and encourages the growth development and multiplication of the lower organic life, and equally bestows its bounty upon organisms which are harmless or dangerous to the life of man. It is our duty to remove the possibility, as far as possible, of the latter receiving that influence and profiting by it, by destroying the other factors of "nidus and pabulum" in the soil without which heat will be of little avail, and the removal of which would put the organisms in a position analogous to the "Seed upon stony ground". By the same means which are adopted to attain this end, we should of course at the same time lessen the number of organisms and spores which are liable to be subjected to the influence of Heat and Soil. These means include a perfect system of drainage, especially taking care to avoid any possibility of leakage from drain pipes, a water carriage system, the establishment where it can be arranged of a definite gradient surface where new buildings are to be erected, the total abolishment of cesspools, and all allied systems of storing excrement. Much good can be done by the flushing of
streets with water, thereby carrying off the loose dust which would presently act as a vehicle of carrying organisms which it contains through the atmosphere to food stuffs. By this means also the earth is cooled in a degree proportionate to the efficient use of the water, and the rise of temperature of the subsoil, which we have seen as an absolute factor in the production of the disease, when it exists to any extent, prevented.

The actual exciting cause of Epidemic Diarrhoea is now almost universally acknowledged to be the product of organisms, but though different observers would claim that power to belong to a single Bacillus, it is more probable that it may be caused by any one of several, or by several acting together. Before discussing the action of those organisms which may be found in diseased conditions, it is well to make some remark upon the normal obligatory flora of the Intestine in health. At birth the intestinal canal of an infant is absolutely sterile and it is feasible that life could be carried on in a healthy condition, without the presence of the organisms which afterwards come to take up their abode in this viscus.

31.
Nuttal and Theirfelder conducted experiments to prove that this is possible. They delivered young guinea pigs from the mother in a sterile chamber, supplied with sterilized air, fed them with sterilized food, and killed them upon the 9th day. It was then found that their intestinal tract had remained free from bacteria. Again, Levin conducted experiments upon animals which were born and had previously lived in the Arctic Regions, where the atmosphere was almost as sterile as that in which Nuttal experimented, and the temperature was against the existence of most organisms in the food or water supply. The intestinal tract was almost sterile, and it was found that the proportion of micro-organisms in air and water was 1 in 11 c.c. while in the water of the Seine the proportion is 2,000,000 in 11 c.c. This also upholds the view, that micro-organisms are unnecessary for the proper assimilation of food. On the other hand, Schotellius has stated that he found it impossible to maintain life in chickens hatched in sterilized air, for more than twenty days. Bilroth, first remarked the sterility of Meconium from the newly born infant. Within a few hours of birth however, bacteria appear in the intesti-
Presences of organisms in the healthy intestine

tine and are passed in the Meconium. These are of three kinds a circular or elliptical shaped micrococcus, the Bacillus Subtilis, and the head Bacillus a long slender rod with bright glistening spore. These may be taken in with the food from the surface of the breast, or reach the pharynx with the inspired air to be afterwards swallowed or enter by the anus. They disappear as the Meconium gives place to yellow faecal evacuations and in the latter another flora becomes established. In the infant whose diet is strictly limited to milk, the flora is almost limited to two varieties, though if this should be varied it is possible to have a much greater number from the presence of inconstant forms. The two which are more or less constantly present are the Bacillus Lactis Aerogenes occupying the upper part of the Intestine and the Bacillus Coli Communis occupying the lower part. Both have been said to take part in the process of digestion, to aid the secretions or even to perform an exclusive part, but on the other hand it has been said that their presence is superfluous, and that they become pathogenic under certain conditions. In adults and at any age when the diet is
varied, as has been already said, the variety is much wider and as many as 30 or 40 different species may be found in the stools. (This is important to remember when it is sought to be believed that one definite organism found in a diseased condition is the particular cause of that disease. For instance we shall remark upon the fact of Kleins Bacillus having been found not only in the stools of patients suffering from Diarrhoea but also in the stools of a healthy subject). Experiments by Gilbert and Dominici bear upon this point of promiscuous dietary accompanied by a great number of organisms in the stools. They examined the stools of a person and found the micro to be 670,000 per milligram, but after milk diet for two days this number fell to 1400, after three days 5000, four days 4000, and after 5 days 2250. In a case of Ulcer of the stomach, in which sterilized milk was given the diminution was much more rapid. Sucksdorf, who made experiments to try to establish the efficiency of drugs as antiseptics to the intestinal tract, came to the conclusion, that only by sterilization of food and the consequent diminution in the number of bacteria introduced, could any appreciable diminution in the number of intestinal micro-organisms be demonstrated. He also found a great diminution, for
whereas the numbers of bacteria were, on an ordinary diet, seen to vary between 2,300,000, the maximum, and 25000 the minimum, after a sterilized diet for a few days the numbers were found to fall to 15000 as the maximum and 53 the minimum per milligram of feces. He had only questionable results upon the administration of intestinal antiseptics. Variations in the individuality of Bacteria occur in different animals and this no doubt is dependent to a large extent upon the preponderance of an animal or vegetable diet. The Bacillus Coli Communis occurs in dogs, cats, hogs, and other animals besides man while in horses, Dyar and Keith have established the fact, that a special variety the Bacillus Equi Intestinalis is the chief obligatory form and that the latter is always present in dung in great numbers. In some animals, owing to dietary peculiarities it is said, organisms may be few in numbers or altogether absent in certain portions of the canal. In rabbits, it is common to find the upper portion of the intestine sterile even during active digestion and Dyar often found their stools sterile. Other varieties may be found in the ileum of rabbits, but Bacillus Coli is not common. The acidity of the gastric secretion has much to do
with diminishing the number of organisms, which would otherwise reach the intestine, and this has been proved experimentally by examining the upper portion of the tract and the stomach after purposely introducing bacteria into the stomach during active digestion. The diminution of organisms progresses proportionately with the increase in the total acidity of gastric juice, but McFadyen, Fermi and others have shown that many pathogenic bacteria including Bacillus of Eberth (and possibly the same may hold with the Bacilli which have to do with Epidemic Diarrhoea) are resistant to even a greater degree of acidity than that found when the acidity reaches its highest percentage during digestion. In adults McFadyen, Nencki and Saiber* found a more or less constant group of organisms by examining the intestinal contents from the fistula at the Ileo Caecal region, and this comprised 24 varieties of Bacilli and a liquefying streptococcus, and the same results have occurred with other observers. Cushing and Livingwood in a series of experiments for surgical purposes, to determine the septicity, the potential septicity, of the intestinal canal at different levels, found the obligatory flora to vary in the contents taken from fistulae at different
levels in the tract, and their conclusions were that there is no stable permanent flora. They could get rid of all varieties by giving sterilized food and allowing a sufficiently long time to elapse for the previous contents to be removed. If this be so all Bacilli including the B. Coli Communis which is present throughout life are therefore transient and facultative. One of the views which we shall refer to is that those organisms which are always present in the Intestinal canal are quite sufficient, without the intervention of any special pathogenic microorganisms, to bring about all the symptoms of Epidemic Diarrhoea, and that they do so by an exaggeration of their normal action, this exaggeration being brought about by conditions which are exceedingly favourable to their vitality.

Whether those organisms which we know to be always indigenous to the human intestinal tract, are capable or not, of having the Diarrhoea produced as a result of their action at the season when this is prevalent in Epidemic form, and when the subsoil has reached a certain temperature another class of organisms come into active existence and find their way through the nutritive supply into the bowel. Different members
of this group which may be very varied are claimed to have the power of producing Diarrhoea and of course if this be so their action will be the more intense if they act in combination. In the Diarrhoeal stools which result from the action of such poisons as may be produced by such organisms, there can be found numberless bacteria. These in many cases and from the particular power which many of them possess produce irritative poisons before they are introduced but they can also continue their pto-
maine producing activity after their ingestion. On separation from the stools many can be cultivated especially in milk, and multiplying rapidly in this medium, they produce at the same time poisons which it is said, of themselves, produce the typical train of symptoms. And further it is not necessary for that purpose that they should be sent directly into the intestinal canal but their injection into the subcutaneous tissues and blood stream is followed by Diarrhoea. Vaughan separated proteid poisons from three of the Toxicogenic germs found and described by Booker as occurring in the intestines of Infants suffering from "Milk Infection" and injected them
under the skin of puppies and rabbits, and this operation was in each case followed by vomiting and purging. He thinks that the number of poisons present in those cases of Diarrhoea following the administration of tainted milk is probably as great as the number of organisms present which produce them, and that while they differ in the intensity of their toxic power, all are Gastro-Intestinal irritants. Tyrotoxican which had been separated from poisonous cheese, ice cream, and other milk products, he isolated from milk a portion of which had been given to a healthy child and had produced Choleriform Diarrhoea. Tyrotoxican is a very powerful toxin producing severe vomiting diarrhoea and prostration and if in sufficient quantity Death in a few hours. The morbid anatomy in such a case is insignificant, for there may be only an anaemic and softened condition of the Mucous membrane and perhaps shedding of the superficial epithelium. But if the animal or child should survive a few days, there may be congestion of the Spleen and Kidneys and the Heart is distended, while the Stomach is distended with gas and contains bile stained mucus, and the Intestine is pale
and contracted at parts and has areas of intense congestion. The substance according to Vaughan which provides the most favourable vehicle and culture medium, for the germs which he experimented upon, is milk or preparations of milk, and many toxins of slightly varying chemical composition, have been separated from infected milk.

Ballard in his report announced his opinion that Epidemic Diarrhoea was "a veritable specific disease of a febrile nature" due to a micro-organism which was not yet detected, captured or isolated. Klein has subsequently isolated an organism which he claims to fulfil Ballard's prophesy. He named it the Bacillus Enteritidis Sporogenes. It is an anaerobic spore bearing bacillus and has repeatedly been found in great numbers in the stools of patients suffering from Diarrhoea, in the intestine of patients who have died from Diarrhoeal affections, and in the food which has been administered to a number of patients who have been simultaneously subsequently attacked by Diarrhoea. I shall mention examples of each, which have been held by the writers to justify their belief that this organism had been the cause of
the Disease. It must be mentioned here that the organism has very often been found in milk which caused no Diarrhoea and in the stools of patients whose motions were normal. The quantity of Bacilli however is said to be very minute in the latter, compared to the number found in Diarrhoeal stools. It is always found in sewage and most sewage contains according to Klein about 500 to 600 spores per cubic centimetre. It is found in manure and all matters polluted by horses dung such as garden earth street sweepings and dust and it has been found in abundance in the soil of the Diarrhoeal Areas of towns, which have been examined for it. In this connection Klein makes an interesting statement regarding malignant Oedema, the Bacillus of which resembles in some respects the Bacillus Enteritidis Sporogenes. Shortly it is this "Injection of manured garden earth under the skin of a guinea pig will cause death in a day or two from malignant Oedema with subcutaneous exudation of a "putrid smelling character". The Bacillus of malignant Oedema does not in pure culture cause this smell in the exudate. I am now in a position to assert that this malodorous malignant Oedema is due to the Bacillus Enteritidis Sporogenes."
It differs from the Bacillus of malignant Oedema by being thicker, its spores are more toward the ends than the middle, it stains deeply by Gram's method, instead of becoming decolorised, and its exudate is malodorous. Other Bacilli which it resembles but from which it can be separated by reagents or by its action on the body are the Bacillus of Symptomatic Charbon, Bothins Bacillus, and the Bacillus of Tetanus. Klein took samples of milk from different shops choosing indiscriminately little shops in back streets and well kept dairy shops. In eight out of ten he found the spores of Bac. Ent. Sp. present. He examined also three samples of what was sold as sterilized milk and found in one of the three the Bacillus in a virulent condition in the second Bacillus Mesenter Vulgatus, which ought to have its spores killed by boiling for three to five minutes, and in the third the Bacillus Mesenter Ruber whose spores ought to be killed by boiling for ten to twelve minutes. Milk is peculiarly liable to have this or other organisms present to contaminate it for it may enter the milk owing to the conditions which prevail at some farms, unclean cans and dishes, or by the water which is
used to wash the vessels (or for diluting the milk) by imperfectly sealed tins during a long railway carriage to the cities, or by contact with unclean hands. The habits of the milkman are certainly not above consideration, for personally I saw during the past Summer in a Midland city, an early morning milkman enter a street urinal, with two milk cans suspended from his shoulders, and both had their lids laid on, so as to imperfectly cover the openings of the tins, the milk being visible to the passer and unprotected from enterprising organisms in the atmosphere. The special characters of Bacillus Enteritidis Sporogenes are, that (1) when grown anaerobically in milk, the milk is curdled quickly with a copious evolution of gas, which causes the curd to be broken and spongy and to have ragged edges. The curd floats upon a clear transparent whey in which the organisms are very numerous (The whey, I have seen turbid and containing flocculi) (2) It is intensely virulent when inoculated subcutaneously into the groin of guinea pigs, and death if the dose be large enough occurs in from 16 hours to two or three days with hae-
morrhagic oedema, and gangrene of the subcutaneous tissues spreading from the point of inoculation. The virulence varies in intensity not only according to the dose administered but also with the age of the cultures. Recent milk cultures are the most virulent and the action may be lost in old cultures. It stains well by Gram's method and has terminal oval spores—points which are important in separating it from the Bacillus of Malignant Oedema and other organisms.

(a) As regards its occurrence in the stools of Epidemic Diarrhoea, Klein quoted a number of cases of Summer Diarrhoea in children and Choleraic affections in adults. Of 10 fatal cases and 1 non-fatal case of Summer Diarrhoea, he found the spores of Bacillus Enteritidis Sporogenes in four. In all the others he found numerous rods and cylinders, which in size, aspect, and after staining could not be distinguished from the Bacillus in question. These he looked upon as being specimens of B.E.S. in a non-sporing condition. Spore-formation is therefore not always present but Dr. Klein did not attempt to explain why there should be formation of spores in some cases in the intestines and not in others. The Mucous membrane was always pale with
patches of intense engorgement, the Ileum distended with a grumous custard like material and the mesenteric glands sometimes enlarged. The cases in which the spores were definitely recovered from the stools were not definitely of a uniform acuteness, nor did they resemble one another in their duration. The 1st had suffered for 1 month, the 2nd eighteen hours only, the 3rd only a few days and the 4th off and on for two months. As the result of eight examinations of Choleraic stools in Adults for his Bacillus and for Cholera Vibrios, where the diagnosis by examination otherwise was doubtful, Klein found the Bacillus Enteritidis Sporogenes in six and though it was not present in the other two, those were apparently better by the time of examination.

(b) An outbreak of Colitis, which has been described by Dr. R. J. Legg, was regarded as being the result of the action of Bacillus Enteritidis Sporogenes, chiefly because this organism was found in the lesions of the bowel and in the stools. During one year from May 1898 to 1899, 54 patients in the Derby County Asylum were attacked and of that number, 28 died. Nineteen Post Mortem examinations were made, and it was found that the changes, comprised in some cases, simply patches of
congestion of the large intestine, in others, ulceration, and in the worst total destruction of the mucous membrane over a large area. In some cases there were also small sharply cut ulcers of the small bowel, in one ulceration of the stomach, and in one haemorrhage into the mucosa. A specimen of ulcerated bowel was examined at the Jenner institute and the ulcer found to contain Bacillus Enteritidis Sporogenes, which also existed elsewhere in the intestine. The Bacilli from the stools were also cultivated and found to contain the same organisms. Sections through the ulcerated patches also showed in the submucous tissue, bacilli resembling the B.E.S. It was found that the Bacilli from the disease was very virulent, but a non-virulent form of the Bacillus was widely distributed throughout the Asylum, being present in the sweepings from the wards. It could however produce slight gangrene in the subcutaneous tissues, haemorrhagic exudate and free formation of gas. He supposed that the organism was capable, in the condition in which they found it, of producing the Disease in patients who were enfeebled or otherwise predisposed but less so in healthy patients.

(c) Dr. Andrews, Pathologist of St. Bartholomew's, contributed an article, detailing the steps in an investi-
gation into an outbreak of Diarrhoea in St. Bartholomew's Hospital which occurred in August of 1898. There had been two previous outbreaks at the Hospital and these were investigated and reported upon by Dr. Klein. It was in connection with the outbreak of 1895, the first of those two, that Klein isolated and described the Bacillus which we have under consideration. Besides being found in the stools of patients in the 1895 outbreak, the bacillus was also readily found in the milk supplied to the Hospital. In the second outbreak which occurred in March 1898, the same organism was found in every stool passed by Diarrhoea patients, examined by Dr. Klein and Dr. Andrews and again it was found in the milk. In the third outbreak (Aug. 1898) three cases were taken at random from separate wards, and in each, the stools being submitted to examination by the Microscope and by culture, the organism was found bearing spores. From the cultivation which was then made, further experiments proved that the Bacilli Enteritidis Sporogenes from each of the three cases were highly virulent. The cultures were prepared by Klein's method; fresh sterile milk tubes were inoculated with two or three platinum loops of the stool and heated to 80°C to destroy everything except the...
spores. They were then cooled and incubated anaerobi-
cally in Buchner tubes at 37°C. In 48 hours all three
tubes showed energetic coagulation and formation of
gas, producing the typical ragged clot floating in
clear whey (Microscopically they appeared to be pure
cultures of Bacillus Enteritidis Sporogenes) Three
guinea pigs were subsequently subcutaneously inoculated
in the groin with 1 C.C. of the whey from each tube.
One died in less than twenty four, and the other two in
less than forty eight hours. The effect upon each was
to produce the typical hemorrhagic oedema and gangrene,
spreading over the abdomen and thorax. Bacilli Enteriti-
dis Sporogenes swarmed in the fluid taken from the
swelling and these were also found in the blood and in
the spleen. On this occasion the milk was not avail-
able for examination, when the Disease became apparent
but the daily supply of milk was examined for six sub-
sequent days and was found on five days out of the six
to contain Bacilli in small quantity. Rice pudding
which was in the dietary of the day preceding the out-
break, seemed to have been partaken of by all those
people who had Diarrhoea, and not by others. That rice
pudding became sour to smell and acid to litmus within
24 hours of being made. Cover glass films prepared
from it, were stained by Gram's method and showed among other organisms a large number of Bacilli resembling the B.E.Spor. in shape and size but without spores. The other organisms present were cocci and small Bacilli resembling the Lactic Acid Bacilli. A number of cultures was made from the pudding, some heated and some unheated, others again aerobic or anaerobic. The cultures which were heated to 80°C all failed as no spores had been present, but an unheated milk culture, incubated anaerobically behaved quite like a culture of B.E.Sp. producing in 48 hours a dense coagulum, ragged and containing gas bubbles and a whey which had Bacillus Ent. Spor. present as well as other organisms, especially small Bacilli like Bacillus Lactic Acid. A large guinea pig was inoculated subcutaneously with 1½ C.C. whey from this milk culture which contained these two forms. In 24 hours it was very ill, with much local swelling over the abdominal wall, and in 48 hours it was worse and in the region of inoculation the abdominal wall was thickened and contracted. On the 3rd day, a Hypodermic sterilized syringe was used to extract fluid from the swelling and the fluid revealed on examination fragments of necrotic tissue fatty droplets and a moderate number of Bacillus Enteritidis Sporo-
genes. An anaerobic milk culture of these was made and developed in the usual manner. With the whey from this culture which contained also other organisms besides the Bac. Ent. Sporog. a 2nd guinea pig was inoculated. Meanwhile on the 4th day the 1st guinea pig died and showed changes resembling those produced by Bac. Ent. Sporog. but with absence of any marked accumulation of fluid. (This it seems is often the case when death does not occur within the first two or three days.) The 2nd guinea pig shewed in two days a remarkable effusion of fluid into the subcutaneous tissues of the abdomen and thorax. It was killed on the third day and all the changes characteristic of infection by Bac. Ent. Spor. were found.

Dr. Andrews concluded that there was sufficient proof to justify him in asserting that the Bacilli in the rice pudding which had been shown microscopically to resemble Bacta Ent. Spor. were truly that organism, though their virulence was less intense than in the case of the Bacilli obtained from the stools of the patient affected by the Diarrhoea. He explains the presence of Bacilli in the rice pudding after cooking, during the process of which its temperature was raised to 98°C. The Spores of Bacillus Ent. Sporog. are
among the most resistant known and will stand a temperature of 100°C for a considerable time. Other patients who had freer diet but did not partake of the rice pudding escaped. The curious and important fact however was that those patients who were on "milk only" and so did not have rice pudding also escaped though it was shown on subsequent days that Bacilli Ent. Spor. was present on every occasion but one, and presumably it was from this source that the rice pudding derived its supply of organisms. With such indistinct and confusing evidence we hesitate to accept the Bacillus as the invariable antecedent though Dr. Andrews "if it be true as it would appear that an organism so virulent to guinea pigs is constantly present in association with acute Diarrhoea and is not found or only occasionally found under conditions in which the intestine is normal it is difficult to avoid the conclusion that this organism has a direct causal relationship" with Diarrhoea. But this statement that it is very seldom found in the stools apart from Diarrhoea is not borne out by other observers for Prof. Hackett Pathologist of King's College has found it in a series of normal stools, present in almost every examination. Against the claim of this organism also is
the fact that it is so widespread and so continually present in the milk-supply, which children and adults take in the vast majority of cases with impunity. Perhaps however it is affected and nursed into a virulent condition by some factor or factors which we have not mentioned among those already noted. Klein attempts to explain this by suggesting that all the Bacilli are not of the same degree of virulence, though all are pathogenic on injection. A comparison can be made by making the normal injection of 1 cubic centimetre into the groin of a guinea pig of 200 to 300 Grames weight, when, if it were virulent death would result in 16 to 24 hours, or again the animal may survive for 28 to 30 hours after a less virulent injection, or again it might recover though extensive tumor and sloughing of skin had taken place. He says further, that the temperature of the atmosphere has to be taken into consideration for that may determine the rapid multiplication of the Bacillus which he has described, while in particular milks there may be some condition, chemical or other which makes them specially favourable not only to the rapid multiplication, but also to the production by the Bacilli of
a virulent progeny. To me, it seems, that considering the frequency with which the Bacillus Enteritidis Sporogenes is found in normal milk and food, and the regularity with which it appears in normal stools according to certain observers, and the fact that Epidemic Diarrhoea is caused by poisons of other organisms, it is going very far indeed to claim it as the almost invariable cause of such Epidemic Diarrhoea. It is much more likely that it is only an indication of contamination of milk and food, by a foreign agent, containing this and other pathogenic organisms of an irritating nature to the Gastro-Intestinal tract. Their presence in large numbers in the food supply, unless existing alone and without the presence of any other organisms, one is justified in assuming, may show the extent of contamination; and recovery from the stools in large numbers, may only be because while aiding others in the production of changes in the intestinal walls, and Diarrhoea, they also have in common with other varieties of organisms found in those changes a suitable medium for their further multiplication and development. Certainly the fact that Dr. Andrews recovered those Bacilli by cultivation from rice pudding, which in the course of cooking would be likely to have most
of its organisms killed, favours the view that it was the cause of the Diarrhoea, which followed the eating of that pudding and no other food. But it is to be remembered that there were also other organisms present whose nature was not further investigated, and even if all other organisms had been killed, the poisons which could quite possibly have been formed by those other organisms, might remain unaffected by the cooking which killed the latter, and such poisons might aid in the production of the Diarrhoea and Gastro Intestinal irritation, or even produce it by themselves without the aid of Bacilli Enteritidis Sporogenes. While such evidence as I have quoted, is strongly in favour of Klein's Bacillus being a factor in the production of the Disease in certain cases, I am only anxious to show, that it does not exclude the possibility of other organisms and their poisons having an equal share in producing the result. Klein's Bacillus is a very frequent inhabitant of milk, which causes Diarrhoea in children. On three occasions in which I have submitted milk for examination, owing to repeated attacks of Dyspeptic Diarrhoea, in one, and a more chronic affection with Diarrhoea in the other two, but in none of which were
the constitutional symptoms severe, the *Bacillus Enteritidis Sporogenes* has been found each time, and the typical ragged clot has been present on culture. On each of those occasions change of diet resulted in ultimate removal of the condition though other means had been previously tried without success.

I must refer to another organism with which the name of Professor Hayem is associated, from his investigation into the form of Diarrhoea with which it is connected. This is the Infantile Diarrhoea of a green colour, many cases of which are to be seen in the course of every summer epidemic. He separated a special organism from the stools, and found that when cultivated this organism produced a green colour in the culture by a substance which it excreted. He says also that this special form of Diarrhoea is very contagious, by spreading on the cloths removed from the child and coming in contact with food subsequently. The reason for saying that it is a particular cause of Diarrhoea, and not allowing that it may be an accidental visitor in the Intestinal tract during an attack of Diarrhoea, seems to be that just as the organism was unable to live outside the body in an acid medium, so when the intestinal tract was
rendered acid by the administration of Hydrochloric Acid, or preferably by Lactic Acid in sufficiently large doses of 2% solution, that some could escape absorption in the stomach and be recovered from the stools in small part, the diarrhoea was cured.

Still another view, and this we have already mentioned, exists as to the origin of diarrhoea occurring at certain seasons in an epidemic form. It is that those organisms, which are always present in great numbers in the intestine, and which are usually incapable by their action of making any deleterious impression, either locally upon the tract or by absorption of their products, more widely upon the system, may under certain unfavourable conditions increase their normal action till that attain definite pathogenic proportions. Those organisms continually produce organic acids, ptomaines and other poisonous products but under normal conditions these are in such small quantity that no untoward effects result from their presence and they are quickly eliminated.

When however food is introduced into the intestinal tract, which has previously begun to decompose by the action of other organic life a suitable soil is provided for the natural organisms of the tract to mul-
tiply and also to greatly increase the amount of their poisonous products which by their irritant local action produce changes in the intestinal walls with Diarrhoea and by their absorption produce the constitutional effects which may exist in a minor or major degree in every case of Diarrhoea. Take for instance the Bacillus Coli Communis. This organism present in the intestinal canal throughout life is perfectly innocent so long as it remains in the bowel, and while the wall of the intestine is healthy and the contents are physiologically pure. It probably plays a considerable part in the normal process of disintegration of food stuffs, and so may be of benefit in that way, while its ptomaine producing activity is not sufficient to be felt as a rule. But let it reach the peritoneal cavity in sufficient quantity and its action at once becomes apparent in producing peritonitis of a most virulent type, while it is mainly responsible for such affections in the neighbourhood of the tract as Appendicitis and Acute Ischio-rectal suppuration. Now when partly decomposed food reaches the tract, irritating or lowering the vitality of the walls of the intestine, is it not possible and highly probable that an organ-
ism which is capable of having such an action as has been mentioned, is also able to set up Catarrh and the follicular inflammation and ulceration which is often found in fatal cases of Diarrhoea? On the other hand even if other organisms be the main cause of producing poisons which set up active peristalsis and start the inflammatory changes in the intestinal wall, is it possible for such an organism as the Bacillus Coli Communis possessing such a high potential pathogenicity, and found so widely spread throughout the tract, to remain inactive in the struggle against the resistance of the tissues? When Diarrhoea develops the proportions of an Epidemic as it so generally does in the third quarter of the year, may it not be because certain chemical changes take place in the milk or other food owing to the heat and other influences, apart altogether from and without the influence of extraneous organic life, and that this altered food is a fit and suitable pabulum for the organisms comprising the natural intestinal flora to produce the poisons, which they naturally do in small quantity, in greatly increased proportions, and bring about all the phenomena observable in the cases which comprise such an epi-
It is at least as probable that the latter is true as that such an organism as Kleins Bacillus Enteritidis or any other single organism is the sole cause, for it has been found necessary in explaining the failure of that organism to produce the disease, when it has been present in both food and stools of healthy individuals, to urge such reasons as:—that it is necessary before the Bac. Enter. Spor. can produce pathological changes in the intestine that it should find certain chemical changes such as I have indicated in the food which forms its nidus and method of introduction; or that in certain cases and under certain conditions the organisms have a much lower virulent power as proved by the failure of subcutaneous injection of the culture to cause a fatal gangrene in the guinea pig.

But we have already quoted evidence that the latter is not the sole cause of Diarrhoea, and that poisons produced by organisms other than it will set up the Disease. It is also certain that the natural flora of the intestine, whatever may be the subsidiary part which they play in every deranged condition of the intestine, is not the sole cause either, for the Hygienic conditions of areas in which Diarrhoea is
known to be prevalent, and the atmospheric and social conditions which determine epidemics at certain times, and in certain places, are too evidently in favour of an extraneous organic origin. What cannot be disputed is, that the conditions of atmosphere soil and social hygiene, under which the number of cases of Diarrrhoea become widespread, are exactly those which alone render the development multiplication and vitality of all organic life, possible to any extent. The organisms which will then flourish are of many varieties, and so also will their products be extremely varied. The great majority are outside the scope of our subject, but such as are widespread and especially such as can be air-borne have many opportunities of coming in contact with and lodging upon such food as will subsequently be used for human consumption. In that occasionally it is easy to understand, if a particularly active species of saprophyte get to work, decomposition will take place, with a result therefrom which could not easily escape an intelligent use of human smell and sight. But certain organisms can also get to work and the result of their labours are poisons which are subtle enough to defy detection by the human senses; and the food which forms
their nidus and pabulum is ingested. Among the num-
ber of the latter are many which act as gastro-intes-
tinal irritants and active poisons when absorbed from
the tract. Just as inorganic substances, of a cer-
tain nature produce poisoning of the different sys-
tems of the body, with an initial and most marked
action upon the specific organ by which they have
been absorbed, so also do those organic poisons pro-
duced by bacteria, and their number is limited no
more than that of the inorganic poisons. There is
no question that the products of some will act much
more quickly and much more intensely than that of
others, and while generally many act in combination
to produce a severe or even a mild attack of Diarr-
hoea an administration of sufficient quantity of one
of the more virulent would be enough to bring about
an intense Enteritis or fatal poisoning even. I take
one instance of meat poisoning an example of many
such, to illustrate the latter point. In Oct. 1899
22 people were treated at Sheffield Royal Infirmary
for poisoning. All of them had partaken of tinned
meat without exception, and no one who had partaken
of this particular meat was known to escape the affec-
tion. In each case, following an initial drowsiness
there was vomiting, pain, profuse Diarrhoea, and Coll-
81.
apse. Under treatment 21 recovered and 1 died. A bacteriological examination was made, and though several putrefactive organisms were found on the upper surface of the meat, the only organism which was present in cultures from the centre of the meat as well as on the surface was the Bacillus Enteritidis of Gaertner. Vaughan's evidence, which I have already quoted, is, if correct, definite that each one of several poisons is capable in the absence of all the others of initiating an attack of Diarrhoea. It will be remembered, that he separated poisons from three separate organisms, which had been found in the intestine in Diarrhoea caused by milk-infection and each of them produced vomiting and purging when injected into puppies and kittens. The mass of evidence which has been tendered about the origins of different groups of cases appearing in Epidemic form, leads one to just such a conclusion as we have mentioned. At any season of the year isolated cases of Diarrhoea which can be traced to an organic origin may occur, and similarly a limited group of cases may at any time follow the administration of milk or other food which has been poisoned by the product of organisms which have found favourable local conditions for their de-
development and activity. These organisms are evidently not always identical, but different cases or different outbreaks may be caused by one or another variety, providing always that they are organisms which produce as a part of their life history poisons which among other properties act as gastro-intestinal irritants. At the season when the atmospheric conditions are favourable, natural forces bring about on a large scale and over a wide area, what, in those isolated cases, has been caused by accidental artificial conditions. They bring into life and active existence a number of different organisms whose spores are evidently at other times dormant in the soil, and these organisms and their spores are carried by dust and other channels into the food, and especially into milk. Generally when the food has suffered any material contamination by such means or more directly by sewage tainted water, many different varieties will be present, though not necessarily any one particularly virulent variety. In such a case the person who has partaken of or had that food administered to him will suffer, if at all, from Diarrhoea varying in severity according to his age and physique.
and to the quantity of the food and the poisons produced in it. It may be an exceedingly mild attack in some cases, in others moderately severe, while in a few the Disease may be exceedingly acute from the outset and prove fatal. It does not seem at all necessary to find "one invariable unconditional antecedent" organism to know that cases arise in this way, for those which are found in one case, and which evidently participate in bringing it about may be totally absent from another; and as we have seen that the products of each of several varieties may without other help bring it about. It would be useful to know what are the special varieties which bring about the small number - comparatively - of what we might call Malignant Diarrhoes. Such are very probably caused by a virulent species which always produces severe poisoning, systemic as well as local, and not only by mild forms having a longer time to produce a larger dose of poison. The Bacillus Enteritidis Sporogenes does not seem to satisfy such a requirement, and is probably only a sign, that the source from which it is derived, has supplied other varieties; for though it has been found in such suspicious associations both in the
food and stools, it has also existed in an intestine which was healthy in spite of its presence. Added to the pathogenic action of whatever foreign organisms there are in the condition, it is most probable that some of the normal intestinal bacteria add their influence to those and accelerate their action either by the production of more poison or by attacking the weakened intestinal wall.

The constitutional symptoms and the post mortem appearances of organs other than the gastro-intestinal tract show that (even in mild cases which have succumbed from any cause) the action of the poisons is not limited to the mere production of a local disease. Besides varying changes in the gastro-intestinal tract, changes which may be comparatively slight or so severe as to show ulceration of the wall and ecchymoses into the mucous membrane. There are further changes throughout the body and these may be apparent in cases of even the shortest duration. The Mesenteric Glands become enlarged. The spleen may be congested, or there may be hyaline degeneration of the arteries, or swelling of the Malpighian corpuscles with degeneration taking place in their centres. The Liver may either be congested or it may be found pale and bloodless, and the former condit-
ion prevails when the disease is of short duration while the latter is apparent if it has lasted longer. There is one condition present in every liver examined and that is fatty degeneration of the liver cells, varying in degree with the duration of the disease. The kidneys, even when showing no change to the naked eye, are found on examination by the microscope to present inflammatory and degenerative changes, intense glomerulo and parenchymatous nephritis even in cases of short duration. The Lungs even if collapsed in parts show evidence of acute catarrhal or catarrhal and interstitial Pneumonia. The Blood may be inspissated and coagulate badly. *Klein.

Dr. Tomkins in the report which I already mentioned and in a subsequent letter to the Lancet affirmed that in his experience Epidemic Diarrhoea was not exclusively or even chiefly an Infantile malady. "The mortality is principally infantile, but accurate observations show that by far the largest proportions of sufferers are patients of more mature years. Of 10,000 known to have suffered during 1887 in Leicester two-thirds were of 20 years and upwards," and from that he drew the conclusion that neglect in the rearing of children was not by any means a prime factor in the causation.
TREATMENT. The measures to be adopted for the amelioration and cure of individual cases during the prevalence of an epidemic are important and my experience has been that what success we may have and can recognise as being due to the aid which we accord to nature depends to a great extent on the systematic employment of these means. (1) To remove the poison already in the intestines and blood (2) To stop the further supply (3) To support the strength (4) To give rest to the bowel after it has been cleansed.

I. In the early stages the first is all important and the means of bringing about such a change should be regarded as specific at this period in spite of the language of Jacobi* He says no specific treatment will ever do, not even the modernised stomach-pump sticking conceitedly out of the coat pocket of the medical man who appears eager to emulate the midwife of our mothers' time with the rectal syringe under her arm as her emblem. But here we surely have a disease where just such specific procedure will do good by removing the cause, which, partly at least, lies within reasonable distance of the physician's reach, and in an area upon which his remedies will act. That the result of his endeavour is not always
successful may be because the disease has progressed too far and constitutional lowering of vitality has put the patient already past remedy. It is true that Diarrhoea (and vomiting where this exists) may not be immediately removed by such means as we shall mention, but their characters are very often changed so as to produce a much less dangerous outlook in the severe cases, and time is gained for the adoption of other remedies. Where vomiting and Diarrhoea have suddenly set in and are incessant, it is advisable to wash out both Stomach and Intestine so far as they can be acted upon by injections. This can only be done when one has acquired the intelligent confidence of the parent in the case of a child. The fluid which I have used generally has been a solution of Chloroform, with about \( \frac{1}{4} \text{ C.H.CI}_3 \) to 111 of warm water. I have repeatedly found this to almost immediately allay the vomiting and to exert a subsequent tranquillising effect upon the child. This fluid besides being an antiseptic, removes mucus, decomposing sediment and organisms with their poisons from the stomach and probably stimulates the surface to a healthy resistant condition. Subsequently a dose of Castor Oil may be administered and
this will now be retained without trouble, or a dose of Calomel combined with Pulv. Rhei in the proportion of 1 grain of the former to 2 grs. of the latter. Whether the stomach be washed out or not and of course such a measure is not necessary in a large proportion of cases which are free of any gastric disturbance, it is well to give one or other of those aperients as a matter of routine. Considering the frequency with which Renal changes are present, and the close association of Infantile Diarrhoea with convulsions many of which are thought to be uraemic, it does not seem advisable to combine Turpentine, with any aperient though this is advocated for its antisepctic properties. On the subsequent visit, whenever it is possible, a rectal injection should be administered even if the case be a mild one for it is not possible to know that the case will remain so, and no period is so favourable for the removal of irritants as the very onset of the disease. For the purpose of irrigation, most satisfactory results will be found to follow the use of a solution of Tannin 5 grains to \( \frac{3}{1} \). This is allowed to flow in through an India-rubber tube, inserted so far as it can conveniently be done without its kinking or bending on
itself, and it is advisable to use considerable quantities. Ostler says that a pint will cleanse the colon of a child of 6 months and a quart that of a child of 2 years. I have used the solution of Tannin much more abundantly and have no hesitation in injecting two to three quarts in a child of two to six years, allowing the fluid to flow in slowly. The purpose is not only to cleanse the Colon but to apply both a cleansing and an astringent action to the intestinal tract over as great an extent of its surface as can be reached. With the larger quantity the resistance of the Ileo Caecal Valve is overcome & the solution finds its way over the lower part of the small intestine. It has been proved that such a reflex can take place for substances which have been ejected in solution have actually been vomitted. Where we should limit the process it is difficult to say but even with the quantities mentioned there is no risk of causing rupture at an ulcerated point or paralytic distension of the bowel. When the bowel has been cleansed in this way by aperients and injections, — the latter measure having occasionally to be repeated at a subsequent stage if there be a relapse and return of symptoms — the administration of a small
starch enema with or without a few drops of laudanum will act as a soothing agent and give rest to the intestine. After this mechanical treatment has been carefully carried out in every case of even moderate severity, and when by its means the greater part of the pathogenic agency has presumably been removed we should continue the war against that part which may have remained in the most inaccessible part of the intestine and with this end in view we employ antiseptic medication. Much difference of opinion seems to exist between authorities as to the value or absolute uselessness of employing drugs with a view to reducing the septicity of the Intestinal tract. In diseases which bear a certain resemblance to Epidemic Diarrhoea, such as Cholera more especially, and Typhoid Fever more remotely, such treatment has been employed with results which have given much satisfaction to those who have had a large experience of such epidemics. Many physicians are quoted by Yeo as having pinned their faith to one or other antiseptic in the treatment of Typhoid Fever, as a necessary adjunct to the careful dieting required and those whom he mentions have apparently had remarkable results. Burney Yeo highly
recommends antiseptics, not only for their effect upon the Intestine itself, but also to neutralise toxines, which having been formed in that position, have already been absorbed into the blood. Professor Ostler on the other hand (in discussing the treatment of Typhoid Fever) says that the attempts to introduce an intestinal antisepsis have not met with success. He further asserts, that many of the substances which are active enough outside the body, are absolutely without any effect on the intestinal organisms, and going further still he condemns the attempt to check bacterial activity even if it were successful. "To check bacterial activity as aimed at by the advocates of an Eliminative and Antiseptic plan would be a disastrous interference with the normal processes in the bowel. No one yet has been foolish enough to claim that so called intestinal antiseptics can kill the pathogenic and spare the useful organisms." He also supports his view of such treatment in Typhoid by referring particularly to the peculiar aspect of the Pathological Anatomy in Typhoid where the Bacterial growth is not chiefly in the Intestine itself but in the intestinal walls, mesenteric glands and spleen. The
reasonableness of the treatment he admits in diseases such as Cholera but in his outline of treatment for the latter disease, again, he ignores the use of antiseptic medication through the mouth. Burney Yeo supports his own and the views of many other men, by a statement which if it apply to Typhoid must do so also to this Epidemic Diarrhoea and allied conditions, viz. "that the structural changes which include follicular ulceration and epithelial desquamation, may be contributed to by a loss of power of resistance in the specifically diseased tissues, to the attack of non-specific putrefactive micro organisms, which are always present in the intestinal canal; so that intestinal antiseptics are as much needed to counteract the local injurious influence of non-specific as of specific bacteria." But the difficulty is to get a reliable intestinal antiseptic for Ostler again says we do not have one at our command. As has been said, this has not been the experience of other physicians for clinical results go to prove that in epidemics of Cholera and Typhoid, there has been a marked amelioration of symptoms and ultimately a great decrease of mortality where there has been
a systematic employment of certain Bactericidal
drugs. Hirsch found in the Cholera Epidemic at
Hamburg that certain drugs had almost a specific
action, and he used Bromol every 3 hours with great
success. Calomel, Thymol, Beta Napthol and Carbolic
Acid alone or with Chloroform have all been used
with evident benefit in Epidemics of Typhoid. Boric
Acid, Creasote and Corrosive sublimate have been
given "Of 171 Typhoid patients to whom Sulphurous
Acid was administered during an epidemic by Dr.
Wilks of Ashford" not one lost his life and there
were few who were not convalescent within fifteen
days of commencing this treatment. Considering
such testimony, antiseptic treatment cannot be
passed over as of no value in Epidemic Diarrhoea,
where the conditions in the bowel are so similar
and the symptoms in the most acute forms are
practically identical with Cholera. Vaughan says
that antiseptics are of no value practically and
as unnecessary dosing is to be avoided medication
should be without them. One would interpret such an
assertion by saying that where we are not certain
of their action, we should not empirically add drugs,
which may have a good effect or not for all we know,
to those which are actually necessary. But I am certain that here we have a condition in which those are necessary and beneficial and in which I have repeatedly seen good effects follow their administration. The time for their administration is after the initial eperient has operated and the bowel has been washed as free as possible from dejecta of all description. A mixture of Beta Napthol, Bismuth Salicylat, Mucilage and may be given every three hours, and at the same time as an occasional starch enema is being used to allay the irritability of the bowel. The good results of this treatment are more manifest in the cases which have lasted a few days before its adoption, for it prevents to a large extent what may not be apparent in the most acute cases but what in the sub-acute and chronic cases forces itself upon our attention. I refer to the putrid smell and the excessively gaseous condition of the stools. If these had already acquired such character, they become better formed and the smell is much less offensive while the frequency of defaecation is also diminished. There is no explanation for such a change other than the probable one, that the antiseptics Beta Napthol, Bismuth Salicylat and Chloroform
acting upon the contents of an intestine whose bacteria are now in comparatively small numbers, lessen the vitality of such as remain, and prevent the excessive activity of such as produce ptomaines, organic acids, Sulphuretted Hydrogen, Indol, Scutol, etc.

The mere administration of one or other of these drugs may have little effect or at least no apparent effect so long as we neglect the employment of such an important and essential measure as washing out the intestine. I have given the mixture above mentioned with suitable dietary instructions, repeatedly without the smallest appearance of benefit but upon carefully washing out the intestine and continuing the same treatment the result has been most gratifying.

Washing out the Intestine, alone, is not sufficient for even with such a measure and the employment of a sedative bismuth mixture, the Diarrhoea will too often be found to return or to continue. The addition of such an antiseptic however, as I have mentioned, is attended with an almost constant sustained improvement unless in those cases where the bowel has suffered severe structural changes in the shape of ulceration and when blood has been a marked fea-
ture in the stools. As has been mentioned, Professor Hayem recommends Lactic Acid, about \( \frac{3}{4} \) or more in the 24 hours, for the green Diarrhœa of Infants, as that quantity will render the acidity of the stools high enough to destroy the special organism which he believes to be the cause not only of the colour but of the Disease.

It is doubtful whether antiseptics so given can have any effect upon the poisons, already absorbed into the blood. In Typhoid Fever, Yeo claims that the Chlorine which is contained in solution in a mixture which he prescribes with Quinine, is liberated and after absorption into the blood, manifests its action there. The condition to which this consideration applies, is not quite on a par with the poisoned condition of the blood in Epidemic Diarrhœa for it has not been suggested in the latter disease that organisms enter the circulation.

II. To stop the further supply of poisonous food we have recourse to supervision of the diet. As in other forms of Diarrhœa, those articles have to be withheld which are indigestible or irritating to the tract, so here we have to observe that precaution, and in addition to prevent the admission of organisms
or their products in whatever is substituted for the previous diet. As milk is the chief article of food among infants who form such a large proportion of the cases in the summer months, the prophylaxis at least such part as the physician can undertake, must include the ensuring of a milk supply which is as nearly as possible free from organic products and infection. When the affection already exists, it is his duty to stop the further supply of infected food and substitute a non-irritating sterile fluid nourishment in its stead. Here it is only necessary to mention the measures which would ensure the milk supply being adequately free from infection, if they were properly carried out. It is seldom indeed that a child breast-fed suffers during an epidemic, when the total number of cases is considered and when such a case does occur it results from infection from the surface of the breast of the mother or wet nurse or from dirty fingers etc. getting into the child's mouth. But a large proportion of children are fed in whole or in part on cow's milk or on artificial milk which is preserved till consumption in tins, and from those sources chiefly the infection reaches the intestinal tract. The ideal source of milk when the mother's breast or a wet nurse is not available would be to have a dairy where the cows are certified to be
healthy, and where their feeding is superintended carefully so as to avoid impurities which could damage the quality of the milk. At such a farm the pasture would be carefully attended to, and cattle houses kept scrupulously clean. The udders of the cows, the hands of the milkers, and the receptacles for the milk all would be absolutely sterilized. The milk would be cooled soon after voiding, and taken to its destination in refrigerator cans, carefully closed and in charge of persons who understood their responsibility.

After delivery special household milk dishes would receive it, and these should be used for absolutely no other purpose. These would be kept in a cool place away from dust and from the atmosphere of living rooms. Considering the suspicion with which tinned meats are rightly regarded by the public, and the intelligent recognition that many comparatively fresh meats are frequently the cause of intestinal trouble, in adults, is it not a little curious that milk so often escapes suspicion though it is the staple food of children who are attacked with summer diarrhoea. One is told that the child had been taken out on the previous evening, or had lain uncovered, or any other probable explanation of a cause that would lead to chill but seldom will the child’s food be voluntarily
brought to notice as the probable cause of sudden profuse Diarrhosa.

For practical purposes in everyday life, when we are not sure of the previous history of the milk before it reaches the consumer, it is well to have it sterilized. Simply boiling the milk for a time will sterilize it, by destroying not only Bacteria, but also their spores, but it has a great drawback in that it produces physical and chemical changes which render the milk less agreeable and less digestible. It is said to lessen the solubility of Lactalbumen and to cause the fat globules and some of the insoluble albuminous matter to coalesce. Pasteurisation of milk while it has a less effective action upon the spores renders those which it does not kill of a very low vitality and almost inhibits their action, and it is not attended by the drawback we have mentioned. It is carried out by keeping the milk at a temperature of 170°F. for 20 minutes in sterilised bottles. Humanised milk is milk Pasteurised, and partially digested, and so modified by dilution with water, and the addition of cream and Lactose, as to closely resemble alkaline human milk. By all these means we supply a food which if it can be borne by the inflamed or irritable bowel, is free from any danger
of keeping up the supply of organisms and toxines or of bringing a fresh supply. But it is a matter of experience that in many cases, no milk or food of any kind can be tolerated without causing upward or downward peristalsis at each administration and so it is advisable in all the more serious cases to withhold altogether any food as such. It is better to supply pure water, or better, barley water or arrowroot water in small quantities frequently than to give a more nourishing liquid of which none is retained. Consequently we withhold milk for one, two or more days, substituting barley water, till the stomach and bowel have had a physiological rest, and then gradually revert to milk pasteurised.

To support the attempt

For this purpose we have recourse to stimulants, which in case of collapse must be given freely. There is no doubt that whisky or good brandy, fresh, diluted with water are most valuable remedies for the weakness and asthenia, which result from the great withdrawal of fluids by the stools and the constitutional derangement and fever. A remedy which Jacobo praising greatly and accept to be one of the best of these toxins is Siberian mastic and this he recommends in doses of 1 to 2 grains in mucilage every 15 to 30 minutes. An occasional enema of water with alcohol in 5% solution is also of use in these dysencephaloid states which are to be seen in chronic cases and by their means a
quantity of fluid is added to the blood.

To give rest to the inflamed bowel. Such measures as we have mentioned previously are all included in this plan. Removal of the cause of the inflammation by injections of water in the stomach or bowel, and castor oil administration, starch enemata, and administration of non- irritating food, will all serve to bring about this result. If the motions should still continue to be too frequent, it is quite advisable to carefully administer solution in the form of Dover's powder and we can give 1/2 gr. every two hours, combined with bismuth subnitrate and mucilage. The hot foment applied to the abdomen is also of great service in allaying the excessive peristalsis when other means fail, and especially so it found useful when the patient is very feverish.

Such means seem to me, those from which we get the greatest benefit in this serious, and taking the immense number of cases which occur, into consideration, highly fatal disease. Especially do I think that good results from the systematic employment of Antiseptic remedies. The other means of combating symptoms which we have detailed are almost unanimously received and acted upon, while this measure is looked upon with reliance or totally condemned. Many antiseptics will suggest themselves and any one of several would be followed by benefit. It is a form of treatment which will be denounced in the future, and which is sure to obtain a permanent place in rational therapeutics.