negative reaction. These cases show that for diagnosis a negative reaction is fairly strong evidence that the disease is not enteric fever. This, I have said above, is not absolute, for 9.8 per cent. of my cases of enteric fever gave a negative reaction.

The last class is made up from 35 patients who were suffering from various diseases, and 3 cases who were in perfect health. Not one positive reaction was obtained. Many pseudo-agglomerations were observed, but these occurred only after the preparation had been made some time; and, as explained above, the false reaction as a whole differs greatly from the true. In fact it seemed very unusual to find diseases, especially if attended with fever, whose sera did not give rise to clumps after a certain period. The motility always seems to become lessened after twenty-four hours, and as a rule a few clumps appeared; and often, indeed, a few clusters of organisms could be seen at once. In one case a typical reaction showed itself in an hour and a-half with a 1 to 2 dilution. This impressed upon me the necessity of fixing a time limit, namely half an hour, for the reaction to take place in. This patient died, and at the necropsy no lesion of enteric fever was found.

I have tried the action of typhoid sera, which react with typhoid microbes, on bacillus coli communis; clumping never took place in a 1 to 9 or 1 to 2 dilution; in twenty-four hours in some cases there were a few clusters, but active motility was retained. I have also tried the action of the urine from typhoid patients upon typhoid organisms. In a few cases this certainly gave rise to clumping, but the result was not so rapid or so clear as the serum reaction. The saliva from healthy people gave clumps as well as that from typhoid patients. Other typhoid saliva gave no sign of clumping. This, therefore, is obviously untrustworthy, and there is no doubt that it is the blood serum which gives the best results.

CONCLUSIONS.

1. Absolutely certain and virulent cultures of bacillus typhosus are needed. If the culture becomes attenuated it will clump to any serum in a typical manner. It is well to examine the culture first to see that there are no clumps before the addition of the serum.
2. It is well to make two dilutions, in the proportions of 1 to 9 and in 1 to 2.
3. It is necessary to have a time limit for the reaction to take place in, from experience half an hour is a sufficient interval.
4. A positive reaction is, I believe, absolute proof of enteric fever (provided there is no history of a former attack), and is found in a very large percentage of cases.
5. A negative reaction is strong evidence against typhoid fever.
6. The reaction nearly always appears in the first week of the disease, therefore the diagnosis can be made earlier by this means than by clinical.
7. The agglutinative power of the serum lasts for an indefinite but as a rule lengthy period, so it is necessary to have evidence as to former attacks.
8. There appears to be no relation between the intensity of the agglutination, the severity of the case, or the degree of the fever.
9. It is undoubtedly the best method we have of certain diagnosis of enteric fever.

[Since writing this Dr. Kanthack has informed me that he obtained a typical positive reaction with serum from a patient suffering from an obscure disease; death followed, and at the necropsy no lesion of enteric was found, and cultures made from the spleen were entirely negative.]

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GASTRO-INTESTINAL TOXINS: THEIR CLINICAL SIGNIFICANCE AND THERAPEUTIC INDICATIONS.

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THE fact that processes are always going on in our bodies, the products of which, by reason either of excess in formation or of deficiency in elimination, may become harmful to comfort, health, or even life itself, should arrest immediate attention.

The morbid manifestations of this condition are spoken of as "auto-intoxication," or "self-poisoning of the individual." Careful study of these processes throws much new light upon the causation of many chronic and intractable ailments, and encourages the hope that an increasing measure of success may attend our efforts to combat them.

Ptomaines, formed from decomposed food substances, had long been recognised as the cause of certain occasional cases of severe and deadly illness. It was not, however, until 1885, when Gautier demonstrated that poisonous bodies, to which he gave the name of leucomaines, were formed from sound food during normal digestion (and in larger quantities and more virulent form if those digestive processes were interfered with), that consideration was given to the possibility of these obscure bodies being responsible for the genesis of many forms of confirmed ill-health.

Gautier's researches showed that the animal economy was frequently poisoned by its own products. He pointed out that poisonous matters were being continuously formed by the decomposition of albumen in the intestinal canal during the process of digestion; and also in the blood and tissues by the metabolism which occurs during the functional activities of life. The normal products of digestion are poisons of considerable power; and if, through inadequacy of the organic functions, they reach the circulation in any considerable quantity, alarming or even dangerous symptoms occur.

Auto-intoxication may be either slight and transient, or severe and lasting. The most common form of all is, I consider, a daily storage of small quantities of noxious material which gradually deteriorates the nervous system, and disturbs the nutrition of the various organs of the body. Vital action is much more quickly interfered with through the accumulation of waste products within the organs than by any want of nutriment of those organs themselves.

The toxins developed in the human body are many and varied:

1. Alkaloids, divided into two groups:
 - (a) Ptomaines, formed from the action of bacteria, or of ferments, on the albuminoid substance of the dead tissues.
 - (b) Leucomaines, which are elaborated by the vital energy of the cells themselves.
2. The primary products of the albuminous decomposition of digestive ferments, such as peptones.
3. Acids—acetic, butyric, valeric, and sulphuric.
4. Ammonia and the ammonia compounds.
5. Leucin, tyrosin, indol, skatol, cresol, and phenol.
6. The salts of potash.
7. Bile acids.
8. Biliary colouring matters, especially bilirubin.
9. Various gases, of which sulphuretted hydrogen is probably the most toxic.

All these are capable, under conditions of excessive formation or deficient elimination, of setting up a train of morbid symptoms without any organic disease being present.

The fact that self-poisoning more or less acute is not constantly present is probably due to two factors:

1. The action of the liver, which seems to have the power, when in good working order, of destroying or modifying certain poisons and of eliminating others.
2. The antagonistic action of the poisons themselves. The chief causes of excessive formation of these poisons seem to be:

- (a) Defective action of the nervous system, leading to a failure of the processes of digestion, such as deficient or abnormal secretion of the various gastric and intestinal juices; or to torpidity of the muscular structures of the stomach and bowels, and a consequent loss of power to make the necessary movements. Then follows retention of food products, and consequent fermentation and putrefaction.
- (b) The taking of food in too large a quantity, in wrong form, or, as is most common, in improper combination.
- (c) Gastric dilatation.
- (d) Duodenal dyspepsia and atony.
- (e) Atony of the small and large intestines.

Defective elimination and failure to burn up the leucamines in the blood by the aid of its contained oxygen are factors of great importance. The kidneys are by far the most important organs of elimination. Much dietetic unrighteousness is forgiven to the possessor of sound and active kidneys; they eliminate two-thirds at least of the solids, especially mineral matter; also urea, colouring, and odiferous materials, but not gases.

Bouchard says that seven toxic substances are found in normal urine:

1. A diuretic substance, which is probably urea.
2. A narcotic substance.
3. A sialogenous substance.
4. A substance which contracts the pupil.
5. A heat-reducing substance.
6. An organic convulsive material.
7. An inorganic convulsive material, probably potass.

The liver possesses the important function, amongst others, of destroying the poisonous properties of peptones, ptomaines, and other substances produced during digestion; and possibly, also, the toxic products of tissue waste. Anything, therefore, which interferes for any length of time with its functions must cause more or less deterioration of the general health.

By the skin is eliminated water, salts in small quantity, carbonic acid, and some volatile fatty acids; and it is interesting to note that in many hypochondriacs fatty acids are eliminated more abundantly by the skin than in normal health. By the lungs are eliminated poisonous substances, such as carbonic acid, and also volatile poisons accidentally introduced into the digestive canal. The bowels carry off much toxic matter; this toxicity is due chiefly to potass and ammonia, and in a less degree to the union of organic principles, especially alkaloidal substances.

Cases of self-poisoning may be divided into two groups, acute and chronic. The first is represented by certain phases of typhoid fever and cholera, and by the more acute forms of uræmia; the second, with which I am chiefly concerned at present, by the slower, but not less harmful, changes going on more or less hourly within the bodies of many of those around us.

I believe that autointoxication is an important factor in the causation of the following diseases:

1. Gout, especially the so-called latent and neurotic forms of that disease.
2. Rheumatism.
3. "Uric-acidæmia" and oxaluria.
4. The nervous irritability attending dyspepsia, especially when gastric dilatation is present, and also the "sinking" feeling some two hours after food complained of by many neurasthenics.

And some forms also of the following ailments:

5. Rheumatoid arthritis.
6. Asthma and wheezing.
7. Vasomotor disturbances as cardiac irregularity and neuroses, false angina, pseudo-Raynaud's disease.
8. Urticaria.
9. Tetany.
10. Migraine and insomnia.
11. Hypochondriasis, and even mental derangement.

With regard to gout and rheumatism Aitken says: "These diseases develop under the influence of agents generated within the body itself through the continuous exercise of its functions in the daily course of nutrition, development, and growth." A considerable experience of gout in its many and various forms has convinced me that in the majority of cases of that disease there is more or less self-poisoning present. And I would venture to submit that from this standpoint we can reconcile the apparently conflicting theories as to the cause of this disease, and also the diverse opinions (each strongly backed by clinical experience) held as to its proper treatment. For whether we incline to the view that gout is due to excess of animal food, to maldigestion of the carbohydrates, to the imprudent mixing of foods of different classes, or to the introduction of substances favouring fermentation, we can see how each of these factors may form toxic material, which (if we accept the recent and most able researches of Dr. Luff) in all probability passes on to the kidneys, where it forms uric acid, excess of which, reabsorbed into the blood, causes the phenomena of gout. For whether defective action of the kidneys, inactivity of the liver, dilatation of the stomach, nerve strain, or want of exercise is considered the main contributing factor to the gouty diathesis, I

would urge that any one of these conditions is capable of giving rise to a condition of autointoxication.

Dilatation of the stomach, a much more frequent condition than generally supposed, leads to the formation, amongst other toxins, of large quantities of acetic and butyric acids. Abnormal conditions in the duodenum cause increase of indol, which points to rapid decomposition and bacterial activity. Sulphuretted hydrogen is frequently formed in considerable quantity in the large intestines. It is a most powerful poison, acting upon both the nervous system and the blood, producing depression, headache, vertigo, and disturbances of sight and hearing.

To get exact indications through the medium of the urine is a most difficult matter, for many alkaloids can only be detected by chemical processes so long, complicated, and delicate as to make them of little use in clinical work. There is, however, a port wine-coloured reaction with ferric chloride which is frequently found in cases of gastric dilatation. Indican again can be detected in the urine by the chloride of lime test, or by the fact that it gives a purple ring with nitric acid; this shows the presence of indol in excess in the small intestine. In cases of fecal retention there is often a brown reaction with nitric acid, which Herschell found in over 50 per cent. of cases of this class. Sulphuretted hydrogen can be detected by the blackening of paper impregnated with acetate of lead as well as by its characteristic odour, and also by the change in the relative quantities of the normal and ethereal sulphates.

The therapeutic indications are important. I have seen remarkable results follow treatment acting upon the nervous system. It is through this that such factors as change of air and scene, visits to elevated inland resorts or to the coast act. I am convinced that in a large number of cases the true key to the position is to be found in the condition of the nerve centres. The kidneys come next in order of importance, then the liver, the bowels, the skin, and the lungs. The vapour or hot-air-box bath is of great service in helping to carry off poisonous substances by the skin.

In typhoid fever Dr. Burney Yeo has had excellent results from the use of a solution of chlorine gas. Dr. Fisher, of King's Langley, has found the internal administration of iodoform of much service, while Dr. Headley Neale, of Leicester, has published a remarkable series of cases treated by the biniodide of mercury.

The drinking of hot water when the stomach is empty is a most excellent practice; it carries away with it much toxic material from the digestive organs, and ends by flushing out the kidneys.

The liver needs stimulation in most cases, and there is no better remedy than a single grain of calomel given every second or third night, followed by a full dose of the phosphate or sulphate of soda in hot water the next morning fasting; the calomel acts also as a duodenal antiseptic. In a number of cases of fairly early deltoid rheumatism, where I have found indican in excess in the urine, the calomel has quickly removed both this substance and the pain at one and the same time.

The state of the bowels should be carefully watched. A saline aperient in the morning is an excellent routine practice, but if much atony be present small doses of aloin and cascara with strychnine and belladonna are indicated. If fecal retention is present, large enemata passed by means of the long tube into the descending colon are necessary.

In gastric dilatation many antiseptics have been tried; amongst others creasote, guaiacol, iodoform, carbolic, and sulphurous acids, and the sulpho-carbolates. Most of these possess the disadvantage of being unpleasant to take, and apt to repeat. I have found a weak solution of fuming hydrochloric acid (8 to 10 drops in 6 ounces of water) freshly mixed just before each meal, of considerable service. It is a most powerful antiseptic; half of the quantity named is taken in divided doses while eating, and the remainder at the end of the meal. Washing out the stomach is frequently useful in severe and obstinate cases; it immediately relieves severe migraine due to gastric dilatation.

When duodenal fermentation is present calomel and betol are the most useful antiseptics. Takadiastase in $\frac{1}{2}$ to 5 grain doses, taken with meals greatly assists the digestion of the carbohydrates. Salol sometimes causes unpleasant sym-

ptoms. The long-continued administration of salicylic acid affects the nervous system, and the salicylate of bismuth is not sufficiently powerful unless given with betol.

As an intestinal disinfectant it is desirable to use some drug which is only sparingly soluble, so as to pass uninjured through the stomach and duodenum; or to have it made into pills specially coated to resist the action of first digestive juices. In that case it often resists also all other efforts to dissolve it, and the drug passes from the body with its coating intact.

Bouchard recommends large doses of iodoform mixed with charcoal; but the former is both unpleasant and toxic. I have found naphthaline much more useful and much less objectionable. It is not absorbed, and may be given in doses of from 4 to 8 grains in cachet. I consider it a most valuable intestinal antiseptic. Methylene blue is also of service in doses of 2 grains twice or three times daily; but the patient should be warned of the deep blue coloration of the secretions caused by it. Charcoal fixes the colouring matter of the bile, takes up gases, and prevents the absorption of some of the products of putrefaction. It is a remedy of great value, especially when given in cachets.

The needle, or circular spray bath, is most effective as a nerve tonic, as is also the double mustard pack. This is made of mustard bran, one portion being applied to the nape of the neck and down the spine, and the other over the stomach and liver, for from fifteen to twenty minutes every second day. It stimulates and strengthens the sympathetic nervous system, especially that portion connected with the process of digestion. The general faradisation of Rockwell is also useful, especially when the hand of the operator is used as the labile electrode. This method, which I consider has not received the attention it deserves, has a most helpful influence in cases of nerve failure. It is pleasant to the patient, and can be administered to the most delicate subject without causing weariness or exhaustion, and in most cases is followed by a feeling of greatly improved health. It may be conjoined with massage, which is indicated in many of these cases; for if we stimulate the nervous system by friction of its cutaneous branches, we obtain, in a reflex manner, quickening of the renal circulation, and, consequently, increased secretory activity of the kidneys.

Resisted Swedish exercises should not be lost sight of; for in the muscles the surrounding fascia forms a pumping arrangement; the two layers of which it consists are separated from each other at each muscular relaxation and pressed together at every contraction. The contained lymph and waste products are thus pumped out of the muscles at each contraction, and are sent into the large lymph spaces and lymph channels. The movements of the abdomen and thorax in the act of respiration form a similar pumping arrangement, by which any excess of the serous fluid which bathes the intestines and the lungs is pumped out of the peritoneal and pleural cavities. These movements also indirectly influence the removal of waste products from the brain and spinal cord. When the brain is overworked and the respiration and muscular movements are underworked the nutrition of the brain is diminished by the imperfect removal of waste products from its substance. Its cells and fibres may also be poisoned by the circulation within the blood vessels which supply them of noxious substances due to imperfect digestion and assimilation. The best remedy for this condition is to be found in bodily exercise; but no course requires so carefully prescribing in these cases as exercise. Excess in this particular at once causes a great increase in the amount of toxic products formed; and the difficulty is that so small an amount is in some cases excessive. Walking, cycling, and golf are all useful; but I have seen many patients (in whom all these caused increase of morbid conditions) completely cured by a course of saddle exercise.

Inhalation of compressed air or of oxygen decreases the toxicity of the urine, as does steady work or labour of any kind; while nothing is so bad as for a person to take little or no exercise for days, weeks, or months, and then suddenly to take violent or long-continued exertion for a short period. Such a course almost invariably causes great increase of toxins in the system.

In uræmia, baths of hot dry air are often of great use, given in

bed by means of Arnold's apparatus. I have often seen children rescued from the jaws of death by this means when constant vomiting, suppression of urine, and convulsions were present. Bleeding should not be lost sight of as a remedy in this complication, for we are told on good authority that we can remove from the system a greater proportion of extractives by bleeding than by any other channel, the renal tract excepted. We should also try to obtain intestinal antiseptics, should use inhalations of oxygen, and act freely upon the bowels.

The question of dietary in auto-intoxication is of the utmost importance. Excellent cures are reported where red meat has been absolutely forbidden, and equally excellent ones where nothing but red meat and hot water have been taken. In amyloseous dyspepsia, with or without gastric dilatation, a meat dietary is often efficacious.

When evident putrefaction is taking place lower down the alimentary canal, or where premonitory symptoms of uræmia are present, then a strict dietary of milk, koumiss, and farinaceous foods is indicated. Alcohol should be avoided as much as possible, especially in the form of spirits. When actually needed I find most useful (unorthodox as it is) a glass of sugarfree champagne, or one of port wine thoroughly matured in the wood, taken with food only. Above all the mixing of different classes of food at one meal should be avoided. In gastric dilatation the meals should neither be too frequent nor too bulky, and fluid should be taken in as small a quantity as possible with food, the necessary fluid being taken one hour before meals.

PARTIAL ANÆSTHESIA WITH CHLOROFORM.

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UNTIL two years ago the rule in the Afzulgunj Hospital was to produce complete anæsthesia with chloroform if the patient desired to have it, in every case, without exception, that was fit for an operation. In a large majority of the cases the operations were of a trifling description and of short or momentary duration, but the Edinburgh doctrine was almost invariably followed, and no operation, however trivial, was performed, or even commenced, before the patient was fully under the influence of the anæsthetic. In this way much valuable time was wasted, and patients who suffered from whitlows, abscesses, fistulae, hydroceles, and the thousand and one conditions which necessitate minor but painful surgical procedures were often incapacitated for a whole day or more afterwards by chloroform sickness or dyspepsia. However, as the Hyderabad Commission has proved that chloroform and shock are incompatibles, and that "primary chloroform syncope" is a myth, the old prejudice against beginning an operation before the patient is "over" was finally cast aside in 1895, and since then nearly all minor operations have been performed under partial anæsthesia with chloroform. In this method the chloroform is administered in drachm doses, poured on to the cap at minute intervals until the patient becomes unconscious. The moment consciousness is abolished the incision, or puncture, or whatever it may be, is made. The chloroform is then usually stopped, and the dressings are applied while consciousness is returning. Partial anæsthesia has been employed in this manner in more than 2,000 cases, and it is now established as a routine method of practice. It is of incalculable benefit in such conditions as hepatic abscess, which cannot be treated successfully in any other way but by aspiration.

Cases of liver abscess are constantly met with complicated by severe dysentery or malaria. At times a cutting operation is inadmissible, and it becomes a matter of almost life and death to the patient to avoid the shock of pain on the one hand, and the possibility of sickness from chloroform on the other. Unconsciousness to pain is easily obtained by partial anæsthesia with chloroform; it is attended with absolutely no risk, and is never followed by the discomfort and sickness which are so often inseparable from full chloroformisation. The only drawback to it is that reflex struggling