ON THE
ANALYSIS AND IMMEDIATE PRINCIPLES
OF
HUMAN EXCREMENTS
IN THE DISEASED STATE.

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I PROPOSE in this communication to begin by showing that there exists an easy and very practical method of analysis applicable to *fæces* in the diseased condition, and which will, I trust, afford considerable assistance in the diagnosis of disorders of the digestive system. I shall afterwards proceed to give an account of the results derived from this mode of analysis, as applied to the *fæcal* evacuations of a few of my patients at the Westminster Hospital.

For the purpose of examining human excrements in a physiological and pathological point of view, I found it necessary to abandon the usual methods of chemical analysis, and adopt a process by which *fæcal* evacuations might be mechanically divided into their immediate principles, instead of being chemically decomposed. M. Chevreuil was

the first who understood the importance of this kind of analysis, and adopted it in his valuable researches on fatty matters; since then, Messrs. Robin and Verdeil, convinced of the weight of the objections against the usual methods of chemical analysis in physiological and pathological investigations, have written their elaborate treatise on anatomical and pathological chemistry, in which M. Chevreuil's views are advocated throughout.

It is evident that an attempt at the extraction and study of the immediate principles of human fæces in a state of disease could not have been made, with any certainty of obtaining accurate results, without a method of analysis having been previously adopted, and shown to yield certain fixed results in regard to healthy excreta. I therefore began by establishing a series of operations which enabled me to analyse the evacuations of men and animals, and then proceeded to a close examination of the immediate principles of human excrements in health.

These investigations¹ were followed by an inquiry into the chemical composition of the evacuations of a patient suffering from malignant disease of the pancreas;² and as these researches presented some interest in a pathological as well as a chemical point of view, I shall allude to the medical history of this case in my present communication.

In the communications referred to I described the mode of analysis I had first adopted for my researches on the composition of human fæces; since then, and after further investigations, I have simplified and added to these operations, and trust I can now venture to offer to the medical profession a method for the analysis of excrements in a state of disease calculated to yield results at least as important as those we have already derived from the analysis of urine. The successive stages of the analysis may be easily understood, by a glance at the accompanying synoptic table.

¹ 'Philosophical Transactions' for 1854 and 1857.

² 'Quarterly Journal of the Chemical Society' for July, 1857.

After having observed the physical characters, such as colour, consistency, odour, and reaction of the evacuations, the pathologist must next proceed to their microscopical examination; and then, if fluid or semifluid, they are to be concentrated on a water-bath until reduced to the degree of solidity of healthy fæces. The mass is now exhausted with boiling commercial alcohol, sp. gr. 850; the mixture being boiled for one minute, repeatedly shaken, and then strained through a double fold of fine muslin; the same operation is to be repeated until the insoluble residue has completely lost its pasty nature. I have been lately in the habit of making use, in this operation, of a strainer, in which the alcoholic extract is forced through the cloth by means of atmospheric pressure. This mode of proceeding is very effectual and convenient in every respect. I shall not dwell on the constituents of excrements insoluble in boiling alcohol; they consist, in health more especially, of muscular fibre, woody fibrous tissue, and other bodies which may be distinguished in the fæces by an ocular or microscopical examination. The alcoholic solution, which has become turbid on cooling, is to be left undisturbed for twelve or eighteen hours; the clear supernatant fluid is then decanted, the remaining mixture thrown on a filter, and the filtrate added afterwards to the decanted portion. The deposit is next to be washed with cold alcohol, and the washings added to the clear liquor; finally, the clear alcoholic fluid must be mixed with milk of lime, prepared when required from caustic lime. I am in the habit of adding about half a fluid ounce of thick milk of lime to the alcoholic extract of one evacuation, and then diluting the mixture with a bulk of distilled water equal to that of the alcoholic extract.

The whole being briskly stirred up with a glass rod, a distinct precipitate will appear, subsiding to the bottom of the vessel, and the fluid may be noticed to have acquired a pale yellow colour; the mixture is to be allowed to stand undisturbed for twelve hours. The residue on the filter which has subsided in the original extract, and is insoluble in cold alcohol, will be found to consist, in the healthy state,

of an amorphous olive-coloured mass, showing no crystals under the microscope. The quantity of this deposit does not appear to vary much in the healthy individual, but in disease it may be greatly increased or diminished, and assume a different colour. This deposit, after having been removed from the filter into a flask, is to be treated with small successive quantities of boiling alcohol, the extract being filtered through paper or calico after each operation, and the process repeated until the filtrate passes colourless or nearly so. There remains undissolved a proportion of the mass, which, when dry, will be found completely devoid of the fatty nature it previously possessed.

The pathologist is now to put aside the alcoholic solution for five or six days in order to allow the substances it may contain to crystallize, and proceed to the examination of the substance insoluble in boiling alcohol left on the filter in the previous operation. It is a singular circumstance that this mass should have become insoluble, when the same substance has previously been dissolved in the alcoholic extract of fæces, and this is undoubtedly an example of one of those curious reactions which organic substances may exert on each other when present in the same solution. The substance in question had been dissolved in the extract of fæces, probably on account of the free acids existing in the liquid; these acids having now been removed, accounts for the deposit becoming insoluble in pure alcohol.

To determine the composition of the deposit, it is to be dried and weighed, and then boiled in a solution of potash, when it will be noticed to dissolve nearly entirely. Next enough hydrochloric acid is added to impart to the fluid a strong acid reaction, and a bulky precipitate of fatty acid will appear. The fluid having cooled, the whole is to be thrown on a filter, and this filter thoroughly washed with distilled water, until the filtrate has completely lost its acid reaction, and fails to produce a precipitate with a solution of nitrate of silver. Then dry the filter containing the fatty acid, under the air-pump over sulphuric acid; finally wash the filter thoroughly with ether, in order to remove from it every

trace of fatty acid ; collect the ethereal solution in a weighed capsule, and by evaporating the fluid to dryness in a water-bath or distilling it in a weighed flask, the weight of the fatty acid may be obtained. Its nature can be afterwards ascertained by obtaining it crystallized in alcohol, and taking the fusing point of the crystals. The filtrate from the fatty acid and the washings may be concentrated and submitted to chemical analysis for the detection and estimation of phosphoric acid, lime, and magnesia. I have observed, however, that the fatty acid and phosphoric acid of the deposit in question, are combined with the earthy base ; margarate of lime, phosphate of lime, and margarate of magnesia may therefore be considered as constituting three immediate principles of healthy fæces.

The analyst must now return to the alcoholic extract of fæces, which has been mixed with milk of lime, according to the directions given above, after decanting the supernatant liquid, the deposit is to be collected on a filter and washed two or three times with distilled water ; the filter and the precipitate are then transferred to a capsule and dried on the water-bath. It is perhaps more convenient to perforate the filter and wash out the lime-precipitate into a capsule, to be subsequently dried. In the dry state the lime-deposit is easily scraped off the paper filter. It is next to be placed in a glass flask and covered to the depth of about half an inch with a mixture of equal parts of cold alcohol and ether, with which it is freely agitated ; the flask is to be closed and allowed to stand for twelve hours, now and then shaking the mixture ; finally it must remain undisturbed for a short time in order to enable the precipitate to subside completely ; and then the solution is decanted into a paper filter, taking care to remove as little as possible of the deposit. The clear filtrate is to be received in a glass capsule, and left in as cold a spot as the temperature of the weather will permit. This operation must be repeated by adding another quantity of alcohol and ether to the lime-residue in the flask, and filtering off some hours later, after which the whole of the lime-precipitate is thrown on the filter. After a period varying

from twelve hours to five days, according to the temperature of the air, the solution deposits in healthy cases an abundant mass of crystals of excretine.

Let the mother liquor be now decanted, or the whole filtered into another glass capsule. Dissolve the crystals in a mixture of alcohol and ether, add some animal charcoal to the solution, and throw it on a filter containing charcoal. This operation having been repeated three or four times, and the charcoal washed with pure ether, a perfectly colourless solution is obtained, which, by spontaneous evaporation or by concentration under the air-pump, yields in the healthy state beautiful colourless crystals of excretine. In the diseased condition, however, as I shall have an opportunity of showing, this result is not always obtained.

In order to proceed with the analysis, lay aside, for the present, the lime-precipitate free from excretine, and resume the examination of the alcoholic extract obtained from the first deposit which occurred in the alcoholic solution of fæces. If after having been exposed to the atmosphere in an open capsule for four or five days, impure crystals have formed in it, collect these crystals on a filter and submit them to chemical examination. They may consist of stearic or margaric acids, or a mixture of the two with or without oleic acid, or finally of an acid or neutral soda soap. In healthy fæces this alcoholic solution, on standing, yields a small amount of an amorphous substance, but I have noticed in diseased excrements a large quantity of a crystallized deposit to occur, under the above circumstances.

The filtrate from the above crystallized or amorphous deposit is to be evaporated to dryness on the water-bath, and the residue to be treated with ether, which dissolves the remaining fatty acids, and leaves undissolved the soap that had not been previously deposited in the alcoholic solution. The soap and fatty acids may now be submitted to chemical examination. In order to simplify the operations, it will be advisable to add the ethereal solution of the residue to an ethereal extract prepared from the above mentioned crystalline deposit and to consider the insoluble residue as the

same substance. I here beg leave to observe that with regard to the fusing points and chemical composition of the fatty compounds obtained by analyses of this description, it is very difficult, if not impossible, to aim at perfectly accurate results; for the quantities to be operated upon are always very minute, and consequently do not admit of being submitted to a complete process of purification; thus, for example, it will not be possible to purify so little as 0·08 gramme (1·235 grains) or even 0·1 gramme (1·538 grains) of fatty acid or of soap; the product must therefore be analysed at once, allowing a small error for impurities.

The lime-precipitate free from excretine is now to be submitted to analysis; it may yield fatty acids and colouring matter. Let this precipitate be dried on the water-bath, pounded and digested in a flask for twelve hours with four or five times its bulk of commercial hydrochloric acid diluted with an equal volume of water. If the lime-precipitate should contain any fatty matters, they will rise to the surface of the solution, and on filtering the fluid will remain on the filter. In case some of the lime-precipitate has remained undecomposed at the bottom of the flask the residue is to be again digested for twelve hours with hydrochloric acid, and the supernatant fatty acid collected afterwards on the filter. The filter is next to be washed with distilled water until the washings no longer exhibit an acid reaction and fail to produce a haziness with a solution of nitrate of silver; the filter is dried under the air-pump over sulphuric acid, and treated with ether in order to obtain a solution of the fatty matter. The fluid, decolorized by means of animal charcoal and allowed to evaporate spontaneously, or concentrated under the air-pump, may deposit white crystals of fatty acids which are to be submitted to chemical examination.

There now remains but one more stage to complete the analysis of fæcal evacuations; it consists in the detection of the immediate principles soluble in water. I have not as yet succeeded in deriving from this part of the investigation results so conclusive as those obtained in the preceding operations, because the acids which, in healthy fæces, might be

expected to be found in this stage of the analysis do not appear to form crystallizable salts. Still I have no doubt that some means will soon be discovered for effecting their extraction. There might very possibly occur in human evacuations, in certain pathological conditions, an organic acid of the acetic acid series, forming crystallizable salts, which suggestion is supported by the circumstance that I have found the castings of certain carnivorous animals, such as those of the tiger, to contain butyric acid ; consequently this part of the analysis of excrements in disease is not to be neglected. These acids must occur dissolved in the filtrate from the lime-precipitate under the form of a soluble lime-salt. Proceed, therefore, to concentrate the filtrate from the lime-precipitate, (I have seen butyrate of lime crystallizing on the surface of the solution during this process of concentration), and, when nearly dry, decompose it with dilute sulphuric acid ; finally digest the whole mass for twelve hours in a closed flask, with a mixture of alcohol and ether ; afterwards decant the solution, mix it with lime, and endeavour to obtain a crystallized lime-salt.¹

Having described the method to be employed for the examination of *fæces*, I shall next proceed to give an account of the results obtained by this means in three different pathological cases.

CASE 1.—John H——, æt. 65. Admitted as out-patient at the Westminster Hospital, on the 22d October, 1856. Has been in bad health since Christmas, 1855. Complains principally of dyspeptic symptoms ; for the last two months has been weaker than previously, and feels pain in the epigastric, umbilical, and lumbar regions. Tongue remarkably thickened, red patches and slight ulcerations near the apex ; the back of the tongue is covered with a thick pale brown fur, which affection began fifteen years ago. In the region of the thyroid gland, and on the left side, is a tumour as large as a small hen's egg, and quite circumscribed, moveable under pressure, and giving no pain ; urine scanty.

¹ Liebig's method for the extraction of lactic acid from flesh.

Notwithstanding the treatment adopted, the severity of these symptoms gradually increased. On November the 1st, the lumbar pain which he refers to the kidneys is become most acute; his urine has assumed a brown opaque appearance, and is occasionally tinged with blood; much pain in the epigastric and umbilical regions.

On the 22d November the pain across the loins is increased; the patient is sick at night and vomits a bitter substance; bowels moved twice a day; motions very light coloured. No appetite, no sleep; he now passes a great quantity of urine at night, which, according to his statement, is as red as blood.

On January the 3d, Hague became an in-patient. Symptoms the same as previously; is troubled with vertigo, and complains of sickness after breakfast; no sleep at night; acute pain, especially in the left lumbar region. At this period I ceased attending the patient regularly, but saw him every now and then in the ward, and afterwards at home; no change occurred in the symptoms, except that he had become emaciated to such a degree that when he died, on the 30th of March, there was hardly any flesh left on his body. Towards the last stage of the disease he suffered from continual sickness, and vomited most of the food he took. His medical attendant treated him entirely with opiates.

I undertook the post-mortem examination on the 2d of April. Body considerably emaciated, legs œdematous; the abdominal cavity was found to contain three quarts of a yellow muddy serum; the small intestines were tinged with bile, and exhibited a few red patches; cellular tissue distended with gas, probably from decomposition; the smell was but slight; kidneys both hypertrophied, and about half as large again as in the normal state; the pyramids were remarkably distinct and pale; pelvis of kidneys filled with a gelatinous transparent deposit, very adherent to the cavity, especially in the right organ. Liver enlarged, hard, and of a blue colour externally; when cutting into its tissue a fluid escaped, containing hard, dark-coloured, sandy particles,

which were easily crushed with the fingers, yielding a stain of an intense yellow colour. The fluid holding the sandy particles in suspension appeared to flow out of a number of minute cysts; the gall-bladder was full of bile and enormously distended; no biliary calculi; pancreas considerably indurated, slightly crepitating on pressure. On making a section of this organ a sensation was perceived, such as would be caused by cutting into a gritty substance; the tissue was found entirely disorganized, and apparently converted into a hard tubercular mass.

Previous to the patient's death, and with the view of throwing some additional light on the nature of the disease, I had examined the composition of his evacuations. This was done on three occasions: twice when he was my patient, and once a few days before he died. He had never taken cod-liver oil at the time of his passing the motions which I analysed. The above evacuations and urine were, at my request, voided in separate vessels, in order to ensure the purity of the former. The patient's motions had the consistence of putty, of a yellow-gray colour, and an acid reaction. The deposit obtained in the alcoholic extract yielded to boiling alcohol a substance which crystallized on cooling; these crystals were found to be partly soluble in ether, the insoluble portion dissolved in hot alcohol exhibiting an acid reaction.

The analysis of 0.275 gramme (4.245 grains) of this substance showed that it consisted of *bistearate*, or *acid stearate of soda*, which must be considered as constituting a new immediate principle of the human body in the diseased state. Its presence in this case results in all probability from the action of abnormally large quantities of free acid in the intestinal canal.

Free fatty acids do not exist in healthy human fæces unless a very large amount of vegetable food has been taken. The excrements in the present instance yielded not only bistearate of soda, but a considerable quantity of free fatty acids; these were obtained in the filtrate from the bistearate of soda, which, after standing undisturbed for some hours,

deposited colourless crystals, consisting of a mixture of bistearate of soda and fatty acids. This deposit yielded to ether the pure fatty acid, which was found to be a mixture of stearic and margaric acids, fusing at 60° C. (140° Fah.), and, according to Gottlieb, corresponding to 18 parts of stearic acid and 10 parts margaric acid. The clear mother-liquor afforded, twenty-four hours afterwards, another crop of beautifully white glistening crystals, which, submitted to microscopical and chemical examination, proved to be margaric acid apparently quite free from stearic acid. Scirrhus cancer of the pancreas is a disease seldom met with. Cl. Bernard reports a case of this kind in his work '*Leçons de Physiologie Expérimentale*,' vol. ii, p. 292, extracted from the '*Medico-Chirurgical Transactions*,' vol. xviii; in which the pancreas was affected with scirrhus cancer, the passage of bile into the intestines being at the same time arrested.

In the case of Haguë, the state of excessive emaciation was an obvious sign of defective assimilation, and this symptom is interesting when coupled with the absence of bile and pancreatic juice in the intestines, and with the presence of large quantities of fatty matters in the fæces. Although it be not possible from a single case of this kind to draw any inference as to the physiological properties of the bile and pancreatic juice in health, still it is remarkable that the absence of the pancreatic juice, which secretion, according to Cl. Bernard, acidifies the fatty matters of food, should have been attended by the excretion of fatty acids; at all events, the excessive quantities of fats excreted are strongly calculated to support Cl. Bernard's views respecting the property of the pancreatic juice to cause the digestion of the fatty parts of food. From the history of the present case we might infer that the existence of a large amount of fatty acids in the evacuations, is to be considered as a symptom of deficiency of bile or of pancreatic juice, or of both, in the intestines; my researches, however, have not as yet been sufficiently extensive to prove the correctness of this view; still, in the two following cases of jaundice, which

are the only instances of evident deficiency of bile where I have had the opportunity of analysing the excrements, they were ascertained to contain a considerable proportion of free fatty acids.¹

It may be interesting to notice that this view is supported by the experiments of Tiedeman and Gmelin, who, after having tied the bile-duct in a living dog, and thus induced symptoms of jaundice, discovered afterwards in the dead animal that the first half of the intestinal canal, after the duodenum and the rectum, contained a considerable proportion of acid fats, which yielded a substance resembling margaric acid. Tiedeman and Gmelin's '*Recherches sur la Digestion*,' part ii, p. 38.

CASE 2.—John H—, æt. 42, admitted as out-patient at the Westminster Hospital on the 18th of March, 1857. Skin of a yellow colour, and has suffered from jaundice for the last two years. Motions occasionally green, and at other times white, like putty; water usually very high coloured and nearly black.

This patient was first treated with calomel and rhubarb, and then with a mixture of iron and quassia; finally he began taking, on the 11th of April, one grain of proto-iodide of mercury twice a day. On the 17th of April the yellow colour of the skin, though still conspicuous, had diminished, and he expressed himself better; that day he brought me some of his excrements to examine, which, at my request, he had taken care to avoid mixing with his urine; his usual diet for this last week has been as follows: beefsteak, bread, potatoes, butter, and tea; he had a few watercresses yesterday; takes no beer or spirits.

The excrements had a grayish colour, of a putty consistency, and acid reaction; when exhausted with alcohol in the usual way they yielded an acid solution; a precipitate gradually subsided to the bottom of the vessel, which, being

¹ Since writing this paper, I have examined the motions passed in another case of jaundice, and found them to contain a large proportion of fatty acids.

collected on a filter and treated with boiling alcohol, yielded a fluid in which an abundant deposit occurred on cooling. The greater part of this deposit was found to be soluble in ether, and after twenty-four hours I noticed a crystalline substance in the ethereal solution; it was collected on a filter and dissolved in hot alcohol, when on cooling it again crystallized. The crystals were perfectly soluble in hot alcohol and in ether; their fusing point was found to be 67° C. ($152\cdot6^{\circ}$ Fahr.) After dissolving this substance in hot alcohol, and filtering the solution through animal charcoal, the first crystals which appeared were found to fuse at 69° C. ($147\cdot2^{\circ}$ Fahr.) There could be no doubt left as to this substance being stearic acid; it had the same crystalline appearance, and when fused resumed the crystalline form on cooling.

The mother-liquor from the first deposit of crystals of stearic acid was next boiled with hydrated oxide of lead, in order to separate the oleic acid, if any should be present. The lead-soap, dried and treated with ether, yielded a solution from which oleic acid was obtained by means of acetic acid. The property of this fatty acid to form a lead-soap soluble in ether, and its fatty consistency, were considered sufficient indications of the presence of oleic acid. Milk of lime being now added to the original alcoholic extract of fæces, a precipitate appeared, which was washed and dried and subsequently treated with a mixture of alcohol and ether. This process, which in the case of healthy fæces yields excretine, failed in the present instance in separating the smallest appreciable quantity of the immediate principle in question; it must, therefore, have been absent. I finally submitted to a quantitative analysis the portion of the residue which had subsided in the original alcoholic extract of fæces on cooling, and had been found insoluble in boiling alcohol. This substance, dried on the water-bath, weighed 0·410 gramme ($6\cdot329$ grains); it was boiled with liquor potassæ, when it dissolved almost entirely; and, finally, the addition of hydrochloric acid to the fluid gave rise to a precipitate of fatty acids. This precipitate was collected on a filter, thoroughly washed with water, dissolved in ether,

and this solution finally evaporated to dryness. The residue weighed 0.223 gramme (3.442 grains). The amount of lime in the acid filtrate was also determined and found to be 0.021 gramme (0.324 grains). Consequently, 100 parts of the deposit contained of fatty acid 90.6 parts; of lime, 9.4 parts. According to Chevreuil, margarate or stearate of lime consists, in 100 parts, of 90.033 fatty acid, and 9.967 of lime.

The substance was therefore stearate or margarate of lime, or more probably a mixture of the two. It occurred under that form in the fæces, and therefore constituted one of its immediate principles. The presence of lime-soaps in this instance must not be considered as abnormal, for I have always found these compounds in healthy fæces.

CASE 3.—John R— has been suffering from symptoms of jaundice for the last few days. He is now better; skin is of a light yellow. Took since yesterday morning three doses of Barberry bark, which I had not prescribed, and has been purged considerably. The motion he brought me was passed this morning (the 15th October); it has a fluid consistence and a yellow canary colour. His usual food is as follows: for breakfast, eggs and bacon; for dinner, none yesterday, but usually a beef-steak or pork-chop; at tea time, bread and butter and tea; and for supper, bacon, potatoes, and scarlet beans.

Examination of fæces.—I much regret that the evacuation submitted to analysis was passed under the influence of a purgative medicine, a circumstance which must greatly diminish its value in a pathological point of view. Nevertheless, it is remarkable that in this case the same excretion of fatty acids occurred as in the previous instances.

The fæces were observed to be quite free from the usual smell of excrements in health. I concentrated the fluid evacuation in the water bath to about one quarter of its previous bulk and then exhausted it with alcohol in the usual way. The alcoholic extract on cooling yielded an abundant

deposit, which was treated with boiling alcohol, and the solution again deposited a white substance on cooling. This substance treated with ether was partly dissolved. The portion of it insoluble in ether was dissolved in boiling alcohol, and the alcoholic solution evaporated to dryness on the water-bath. The residue weighed 0.169 gramme (2.609 grains). I dissolved it in hot water, when, by the addition of hydrochloric acid, a precipitate appeared. This precipitate being collected on a filter, thoroughly washed with distilled water and subsequently treated with ether, yielded a solution which contained 0.148 gramme (2.284 grains) of a dry substance, having all the properties of a fatty acid. Its fusing point was between 64° and 65° C. (between 147° and 149° Fahr.) Therefore, according to Gottlieb, it consisted of 22 parts of stearic acid and 10 parts of margaric acid.

The acid solution obtained by decomposing the residue with hydrochloric acid was found to consist of chloride of sodium; 100 parts of the compound consisted therefore of fatty acids, 87.57; soda, 12.43; but, according to Chevreuil, a neutral soda-soap of stearic or margaric acids contains in 100 parts, fatty acids, 89.02; soda, 10.98. Consequently, the compound in question was a soda-soap, consisting in 100 parts of 31 parts of margarate of soda and 69 parts of stearate of soda.

The nature of the substance soluble in ether was next examined; it had an acid reaction, and being allowed to evaporate spontaneously for twenty-four hours, yielded a mass of white crystals of fatty acid, containing a considerable proportion of oleic acid, and fusing at 38° C. (100.4° Fahr.) It was a remarkable fact that the first crystals deposited did not fuse even at 100° C. (212° Fahr.) They appeared to consist of a small quantity of soap which had been dissolved in the ethereal solution. The dried mass of fatty acids weighed 0.437 gramme (6.746 grains).

I now proceeded to evaporate to dryness the mother-liquor which had deposited the fatty acids and soap. The yellow residue obtained from this operation was treated with ether,

which dissolved a quantity of impure oleic acid, fusing at 38° C. (100.4° Fahr.) This substance, previously decolorized by filtering its solution in ether through animal charcoal, was ascertained to weigh, when perfectly dry, 0.393 gramme (6.067 grains). I now purified the colourless but impure oleic acid by transforming it into a lead-plaster, which was treated with ether, and this solution was subsequently decomposed with tartaric acid; the oleic acid thus obtained fused at 23° C. (73.4° Fahr.) It was ascertained by means of the microscope to contain crystals of fatty acids, which accounted for its high fusing point. Pure oleic acid fuses at 15° C. (59° Fahr.) The small proportion of the yellow residue insoluble in ether was found to be soluble in hot water. The addition of hydrochloric acid to this solution inducing a white precipitate, the residue consisted evidently of a soap.

The clear alcoholic extract of fæces filtered from the deposit which had occurred on cooling was mixed with milk of lime, and the precipitate treated in the usual way for the extraction of excretine; but not a particle of this substance could be obtained. It evidently did not exist in these evacuations.

Finally, a fresh quantity of fatty acid was extracted from the lime precipitate by decomposing it with hydrochloric acid. After thirty-six hours a green substance was noticed floating on the surface of the solution; it was collected on a filter, and dissolved in boiling alcohol. Another week having elapsed, the solution was found to have lost its alcohol by spontaneous evaporation, and yielded a deposit of crystallized fatty acids. This deposit, after having been thoroughly washed with water, was dried, and ascertained to weigh as much as 1.440 grammes (22.230 grains); its fusing point was 37° to 38° C. (98° to 100° Fahr.), showing that it contained a large proportion of oleic acid.

It was not possible for me to determine with any degree of precision the form under which these 1.440 grammes of fatty acids existed in the fæces; they may have been combined with soda or potash, which soap the lime-water might

have decomposed. I am, however, inclined to consider their presence in these excrements as occurring under the form of free fatty acids.

This case, independently of its pathological interest, will contribute, I trust, to illustrate the mode by which fæces are to be analysed in disease.

In conclusion, I beg to acknowledge the valuable aid of my assistant, Mr. Frederick Dupré, P.H.D., in these and other investigations.

SYNOPTIC TABLE, showing the method to be adopted for the Analysis of Human Excrements.

Excrements exhausted with alcohol, and strained through a cloth.	An insoluble residue left on the cloth.	<p>A deposit which, exhausted with alcohol, yields</p> <p>A solution yielding on cooling</p>	<p>An insoluble residue.</p> <p>A solution.</p>	<p>{ This residue is to be dissolved in potash, and the solution decomposed with hydrochloric acid. Examine the solution for the detection of phosphoric acid, lime, and magnesia, and the precipitate for the detection of fatty acids.</p> <p>{ A crystalline deposit on standing (<i>fatty acids and soaps</i>).</p> <p>{ A residue, when evaporated to dryness, which, when treated with ether, yields { A residue insoluble in ether (<i>soaps</i>).</p> <p>{ An ethereal solution (<i>excretine, colouring matter</i>).</p> <p>{ An insoluble residue, which, decomposed with hydrochloric acid, yields { A solid substance, soluble in ether (<i>fatty acids</i>).</p> <p>A solution. It is to be evaporated to dryness, decomposed with sulphuric acid, exhausted with a mixture of alcohol and ether, and this solution tested for <i>organic acids</i>.</p>