Acta

On The

Absorption of the effete matters of

the

Intestinal Tract, as a cause of

Anæmia (Fecæmia vel Fæcal Anæmia)

and other blood diseases.

By

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During my Medical Studies, it has often occurred to me, whether under certain disordered states of the Bowel, it is possible for the Excrementitious matters of the intestinal tract to become absorbed into the blood, and there Exercise a direct pernicious influence on that fluid, and perhaps also on other tissues of the body.

This impression first occurred to my mind on purely theoretical grounds, but as my clinical experience has increased, I have been more inclined to regard it as a very probable factor in the causation of many disordered Blood States.

The subject is to me one of great difficulty, as I cannot find a Single reference to it in any of the Standard Medical works I have Consulted.

My principal reasons in bringing the subject before the Faculty is to try and ascertain in how far certain well marked Symptoms, (including Anaemia) appearing in the course of many intestinal disorders, can be traced to have their origin in this feculent absorption.

If such can be demonstrated to be the case, it will no doubt lend us valuable aid in the

treatment of certain anaemic states accompanying digestive disorders.

Physiologically, we are certain that the Mucous covering of the small intestine is both a Secretory Surface, and a Surface capable of absorbing many substances in liquid form.
The lobulated glandules of Brünner in the Duodenum, and the Lieberkühnian follicles throughout the whole course of the small intestine, constitute the Secretory apparatus of the small intestine proper.
The absorption of liquefied and digested food stuffs is accomplished by the numerous villi, covering the entire mucous surface of this portion of the bowel.

As to the Large Intestine, there can be little doubt but that the Lieberkühnian follicles here, have a function similar to those in the small intestine.
Ranke in his "Physiologie des Menschen" page 297. Leipsic 1872 states that he has succeeded, after ligaturing the Vermiform appendix of a rabbit, in obtaining the Secretion from

these follicles; and has shown that it has the property not only of transforming starch into sugar, but also of decomposing the sugar with the formation of Lactic and Butyric acids.

Although this seems to be true of the Secretion from these follicles in the first part of the large intestine, I am inclined from observation, to think, that the similar follicles in the lower 2/3 of the large gut, Secrete a mucus like matter which accounts chiefly, if not entirely, for the characteristic odor of the faeces; and what lends probability to this view is, that, in different animals, whatever the nature of the food, the faeces have a distinct odour, characteristic of the species.

During my Physiological studies in Berlin in 1881, I had an opportunity of experimenting on several rabbits, with the view to ascertain the nature of this Secretion from the Lieberkuhnian follicles of the large intestine.

Under Chloroform, I fistulized the Caecum of a healthy rabbit, in Situ, and succeeded, in about an hour, in obtaining half a drachm of the Secretion without admixture with food. This, I collected in a small

test tube kept as near as possible, at a temperature of 38°C.

Previous to so doing, I painted the mucous surface of the ligatured caecum with a grain of Cayenne pepper to increase if possible, the secretion.

Failing to detect saccharine matter in the contents of the test tube I added a few chips of freshly prepared starch, and at the end of half an hour; succeeded in obtaining a slight but definite sugar reaction with Fehling's solution; thus bearing out Ranke's statement as to a possible function of this "caecum intercus"

I ought to state however, that I was not successful in getting the sugar reaction after the addition of the starch, in all instances, for out of 5 experiments I only succeeded in finding sugar in 3—

As to the cause of this failure. I am not prepared to say.

In 4 other rabbits, I ligatured, about 3 inches of the large intestine, some little distance above the rectum, and after waiting for 2 hours, or even more, in 2 instances, failed to obtain any secretion whatever.

In two of my experiments, I was fortunate enough, to find, on opening the ligatured intestine, a scanty

Secretion, not unlike mucus, and with a distinct feculent odour. To this viscid liquid, two drachms of distilled water (previously shown to contain no Sugar) was added, in a test tube, kept at a similar temperature in all the experiments; and then some starch solution added as before, but the results were negative; thus showing that the Secretion from the lower portion, at least, of the Large intestine, has no action on starch; as the Secretion in the ascending Colon seems to have.

Other observers have shown from experiment that this Secretion has no action whatever on coagulated albumen or on the neutral fats, or fibrine -; so we may conclude by stating that, in the normal state of the Large intestine, ~~chyme~~ the "Succus Entericus" has the power of ~~diastasic~~ forming Starch into Sugar, and the Sugar into Lactic and Butyric acids; [redacted] in the ascending colon at least, but this its action on food stuffs appears to be nil, in the transverse and Descending Colons - Here it probably acts in a mechanical way - Similar to the Buccal Secretion during mastication.

I think, then, there can be little doubt, as to the secretory power of the mucous covering of the large bowel.

But very little opinion is expressed in the physiological works of the day, as to its property of acting as an absorbing surface.

Although villi are not met with in the large intestine, it does not at all follow, may & does not take place. (that absorption)

It has long been known that nutritious fluids, thrown into the rectum are retained there, and in time absorbed by the mucous membrane; and two cases of intestinal fistula are on record (Archiv: für Pathologische Anatomie, und Physiologie.

Band XIV. page 140,

and Band 75. page 419.)

in which food was shown to be absorbed by mucous coat of the large intestine, on being introduced through the fistulous opening.

Both cases point to the fact that absorption per large gut is a highly probable function of a part of the colon at least, in health; and if such is the case in health, I fail to see why it is not likely that in disordered states of the bowel, such as Constipation & ulcerated intestine, the effete matters in part, and in liquid form, may not pass Entrance to

the blood, and there act on it,

Although the effete matters of the bowel, having the characteristic faecal odor are only found below the ileo-caecal valve; yet we must regard the contents of the greater part of the ileum as effete substances, because the nutritious portion of the bowel contents, must, in all probability be absorbed soon after their admixture with the biliary and pancreatic juices.

The faecal odor in the colon must not be regarded, however, as being due to putrefactive changes in the contents, as I have already shown it to be due to the characteristic secretion of the Lieberkühnian follicles in the mucosa of this part of the bowel.

Normal excrement consists largely of the undigested substances derived from the food, and also of excreted material from the Alimentary Canal. The larger portion, derived from the ingesta consists of animal and vegetable tissues which from their constitution are incapable of digestion; such as elastic fibres, bits of elastic tissue,

shreds of tendon or fascia not sufficiently softened by cooking; horny epidermic tissues, both of animal and vegetable origin; and the spiral tubes and ducts of vegetable substances.- & albumen.
The excreted materials ~~of~~ which go to make up the remainder of the faeces, are the mucus of the large intestine, as well as the secretion from the Lieberkühnian follicles; the bile pigments which have previously escaped solution or decomposition; the Cholesterine and salts of the Bile, and also the insoluble salts of the Pancreatic, and intestinal secretions.-
The volatile substances which are probably the cause of the faecal odor, are derived from the Succus enterious secreted by the middle & descending Colons;
Indol ($C_8 H_7 N$) discovered by A. Baeyer has an odor not unlike human faeces and to this substance some chemists are inclined to put down the odor of the faeces. (Hoppe Seyler). It is soluble readily in hot water, and slightly so in cold water.
Berzelius gives the following as the composition of the faeces- and I have taken it from, Thomson's Chemistry Vol. IV page 555:-

an

Analysis of Faeces (Human)
according to Berzelius,

1) Water ---------- 75·3

2) Matters Soluble in water { Bile .... ·9, Albumin ... ·9, Extractive 2·7, Salts 1·2 } 5·2

3) Insoluble residue of food (Chiefly Starch grains, woody tissue, particles of cartilage fibrous tissue; undigested muscular fibres or Fat, with insoluble substances which are accidentally introduced into the food.) 7·0

4) Insoluble matters added in the intestinal tract :— mucus; Biliary resins; Fat, and a peculiar animal matter ---------- 14·0

102·0

Besides Solid Faeces, the bowel contains even in health a considerable Quantity of Gaseous matter. The presence of these gases is constant So it is not likely to be a mere accident that they are present; but intended to serve some definite purpose.
The Gases of the Bowel are Attained from

Several sources which I will enumerate.

1) Air introduced in the act of swallowing food or saliva

2) Gases developed by the decomposition of alimentary matters, or of the secretions and excretions mingled with it in the stomach and bowels—
This seems to me to be the principal source.

3) Gases derived from the blood, from the mutual interchange which must likely occur between the gases in the alimentary canal and those in the blood of the intestinal blood vessels. The conditions of this exchange are as yet unknown and it is very doubtful whether anything like a true and definite secretion of gas ever takes place from the blood into the intestines.

There can be no doubt, however, that the intestines may be the proper excretory organs for many odorous substances (gases) either absorbed from the air respired, or absorbed in the upper part of the alimentary canal, again to be excreted at a portion of the same tract lower down — in either case, assuming rapidly a gaseous form after their excretion, and in this

way, obtaining a more ready egress from the body—

As I have already said, there can be no doubt about this property the bowel has of excreting gas from its surface; and in my mind there can be equally little doubt that the bowel has the power of absorbing the gases of the bowel, in diseased states, ~~into~~ and thus gaining them an entrance into the blood—

From the Analyses of Swine, Magendie, Marchand and Chevreul, as quoted by Dr Brinton in his work on food and its digestion, I find the following to be the composition of the Gases of the Alimentary tract in its various parts:—

Whence obtained	Oxygen	Nitrogen	CO_2	H	CH_4	H_2S	
Stomach	11	71	14	4	nil.	nil	= 100
Small Intestine	nil	32	30	38	nil.	a trace	= 100
Caecum	nil	66	12	8	13		= 100
Colon	nil	35	57	6	8		= 100
Rectum	nil	46	43.	nil	11		= 100
Expelled per anum	nil	22	41	19.	19	½	= 100.

All the above mentioned gases are soluble both in water and in the Succus enteriecus of the bowel.

In healthy states of the bowel it is probable that a large proportion of the gaseous contents of the bowel is absorbed. From this interchange of gases; but I am inclined to think only a small amount of the Effete solid matters is absorbed. — The mucous Covering of the bowel merely supplying the necessary secretions which will prevent the Effete matters from becoming indurated, and by this means hindering their impaction which would be a Serious matter.

In this respect there seems to be in health, a state of Equilibrium between the contents of the blood vessels and Lacteals in the Submucous coat, and the Effete matters passing over the Epithelial Covering of the mucous coat.

But supposing from some cause the intestinal Juices are deficient in Quantity, or from the nature and large amount of the ingesta, that the faeces become hardened, this state of Equilibrium must of necessity be upset.

The Effete matters being hard, and pressing on the bowel, will cause an increased peristaltic

and from this muscular contraction, the glandular structures in its walls are compelled to secrete their contents.

These juices after a time may succeed in absorbing this hardened feculent matter, and by this means, Nature prevents Constipation from setting in for any lengthened period.

But, on the other hand, let us glance at what must take place in cases of prolonged Con-stipation where the effete matters have been deprived of all their liquid portion.

The only Conclusion we can arrive at is that it must become absorbed by the lymphatics of the bowel and thus fouled the blood.

This being the case we must next Consider what substances in the faeces are capable of thus being absorbed.

By far the largest Constituent of the faeces is the water which is capable of rapid absorption.

Besides this, we find a variety of constituents soluble in water or weak alkalies — among these are included. Bilirubin from the bile - soluble in alkaline fluids - Biliverdine - soluble in alkalis.

(the former, having the composition of $C_{16} H_{18} N_2 O_3$ (Hoppe-Seyler)

The latter - - - - - - - - - - $\left\{ \begin{matrix} C_{16} H_{20} N_2 O_5 \text{ (Staedeler} \\ \text{or} \\ C_{16} H_{18} N_2 O_4 \text{ (after Maly} \end{matrix} \right.$

Cholesterine, albumen, Extractive matter - a portion of the salts; the volatile substance allied to Indol $C_8 H_7 N$ - which is readily soluble in water or in alkalies if somewhat warm; and the Lactic and Butyric acids already mentioned as being formed by the action of the Succus Entericus on the bowel contents. In addition to these there are the Carburetted Hydrogen Carbonic acid - Nitrogen - and Hydrogen. & Sulphuretted Hydrogen Gas are always present and readily Soluble.

Although not found in Analyses of the Faeces, we must take into account the large quantity of Biline (Glycocholate of Soda / Taurocholate of Soda) which is absorbed by the Small and large intestinal mucous membrane; and the fats of the bile Caseine & Oleates, Margarates and Stearates of Soda & Potash which are also absorbed, even in health -

Lastly we must recollect the Sulphur present in the Excreta where it is combined with the remnants of the Biline - (especially the Taurocholate preparation) The Sulphur which is present in the Taurine to the extent of 26% is Soluble, and is, I think a Source at least of the Sulphuretted Hydrogen so often passed per anum in Bilious & dyspeptic Cases,

In cases of prolonged constipation, I am inclined to think that the volatile & perhaps other substances in the faeces, such as Indol C_8H_7N, as well as the various gases of the bowel, are absorbed into the Lacteals or bloodvessels, along with the Glycocholates and Taurocholates which latter are normally so; and to this absorption I am inclined to regard many of the definite Symptoms of constipation as being due.

In such cases it will usually be found, that although the same kind of food is daily consumed and in the same or even greater quantity than previously, yet that the alvine discharges, instead of coming away daily or every 2nd day are retained for a week or more. Now, absorption of ~~this~~ a portion of the effete matters is the only explanation of this frequent occurance.

The Symptoms of habitual constipation are generally Headache, malaise, furred tongue, foetid breath, nausea — sometimes feverishness — and in prolonged cases well marked Anaemia.

Urates are generally found in abundance in the urine.

Mason Good in the 1st volume of his work at page 229 cites several unusual cases with the above Symptoms.

For instance Rhodius gives a case of Jaccos retained for a month; and Panarolus one of 3 months retention without mischief beyond anoemia. Examples are also quoted from:-

Salmuth Cent. I. Obs. 24
" " II " 65
" " III " 26 and 45

of Jaccos retained half a year, and in one case 2 years, and in one or two instances 7 years without mischief— Again, Professor Thomassini of Parma in 1808 attended a man aged 30 years, who had been habitually costive since his youth, but ate twice as much as other men. He vomited every 8 or 10 days, and only suffered from headache anoemia & turbid (probably urates in) urine. The effete products in this case must have been absorbed — otherwise the patient could not have eaten so much, and there is nothing in the history of his case to lead us think that the excess of food went to build up his body, because he was anoemic.

In all these severe cases as well as in cases met with in private practice, we find Lassitude, anoemia, and in most instances a quantity of urates in the urine. Now, these urates present are related to

be derived ~~from~~ partly from the unassimilated elements of nitrogenous food stuffs which have already gained the blood; and partly from the disintegration of the azotised animal tissues; but besides these certain sources, I think, that the urea present in cases of prolonged constipation can be traced to have its origin from the absorbed intestinal gases (CO_2, H_2. H_2S,, CH_4,, H) and volatile and other substances, such as Indol $C_8 H_7 N$—

That urea in the blood may cause headache, and lassitude, there can be little doubt— In cases of so called Uraemic headache (a term restricted to the headaches accompanying Bright's disease — but which might with advantage be extended to the headaches accompanying habitual constipation) we find that constipation setting in, severely increases the pain in the head—

That urea has a pernicious influence on the blood capsules, will afterwards be shown; and this point shows us that if, from such a source as the bowel, Urea and other waste substances float in the blood in excess, they will cause the ~~to~~ partial destruction of its elements — thus

causing Anaemia

Anoemia is a prominent Symptom in cases of habitual constipation, and as its origin cannot be put down to impaired appetite, because many constipated people, as I have already shown, eat more than healthy individuals; we must regard it as being due to the pernicious effect which the absorbed gases and effete nitrogenous matters exercise themselves, or in a transformed state (e.g. urea) on the blood.

Again the depression of body and mind accompanying so frequently Constipation cannot be alone accounted for by the mere mechanical pressure of the retained and hardened faeces; but to some poisoning from waste products floating in the blood.

This depression and Anoemia are well seen, in the convalescent stage of an ordinary Tonsillitis — so much so that we are justified telling the patient he will be anoemic & weak for a considerable number of days after his throat is cured.

Now there cannot be anything in the condition of the local throat affection to account for such constantly met with Symptoms; but as Constipation is nearly always present (with urates in the urine) I regard the Symptoms as being due to faecal absorption.

Bearing this view of its causation in mind, I successfully treat cases of Acute Tonsillitis ~~with~~ accompanied by Constipation with aperient doses of the Carbonate of Iron either alone or combined with Electuary of Senna, and Potass: Et Sodae Tart.

Before leaving the subject of Constipation, I would refer to that of Intestinal obstruction for a moment. The symptoms of this disease are vomiting which becomes Stercoraceous and afterwards faecal; headache; complete prostration followed by unconsciousness and in one case I attended, off obstruction from strangulated femoral hernia there was coma, with thick deposit of urates in the urine.
All these symptoms I regard as being caused by faecal absorption & in cases of Chronic obstruction marked anaemia invariably sets in.
Long before the vomiting becomes distinctly faecal, the breath has a Stercoraceous odour which I think is due to faecal matters in a state of decomposition passing through the Pulmonary Circulation. Besides this odor of the breath, I also regard the foetid breath in Diarrhoea. Constipation. Typhoid fever & Chronic anaemics, as being due to the same cause — the odor being derived from the blood in

the lungs, and not from the stomach itself as many suppose.

I cannot see how it is that when we ask patients to blow in our faces so that we can re-cognise the smell of the breath, that this can give us any notion of the state of the stomach; no more than we could tell that Whisky existed in the stomach by smelling the breath.

In both instances - the odor is one given off from the blood and this is I think, another argument in favor of my view that in disordered bowel states the fluids of the faeces ~~along with~~ the intestinal gases especially CH_4. H_2S. and CO_2 are absorbed into the blood where they give rise to certain symptoms of a definite character.

The symptoms caused by their presence in such instances as the above, will, on comparison with the symptoms caused by similar gases and substances in Sewer gas poisoning, be found very much the same.

Besides Constipation, there are, I think, many other disordered bowel states in which the effete contents may become absorbed, and among these we find Diarrhoea especially at the latter stage of the complaint.

Before a natural cure can be effected, the contents of the lower bowel become harder from absorption of their watery part ~~of the~~ and thus the fluids Gesta higher up, if unable to soften this, must of necessity be absorbed.

This would account partly for the Constipation so frequently succeeding Diarrhoea, and also for the depression; headaches. foul breath & tongue; and especially for the Urates passed in the urine, as the flux from the bowel is becoming arrested.

Another fact which lends probability to this view of absorption, is one which I know from personal experience. If during an attack of Diarrhoea, ~~the~~ one imagines the lower bowel emptied, but soon after coming from Stool, feels liquid again in the rectum, ~~without~~ and does not attend to natures call a second time, he will find that on going to Stool next morning, or many hours afterwards that the contents of the rectum are of their natural

consistence, or even harder than normally—
showing the liquid must have been absorbed by the
lymphatics of the mucosa

Passing on to Fevers, Craigie in his Practice
of Physic tells us has frequently the mucosa of the
bowel is affected — either covered with Petechial spots
or congested throughout its entire course — sometimes
softened and sometimes thickened — with definite ulcers
in Typhoid fever in the patches of Peyer and Solitary glands,
In Typhus fever, we find congestion or inflammation
of the intestinal mucosa especially in the colon
(Roberts Practice of Medicine vol i page 169.
and in Relapsing and Yellow fevers, constipation will soon
thrush.
From this comparatively General Combination of the
intestinal mucosa in fever, I feel inclined to regard
the absorption of faeces as a possible factor in
the causation of the symptoms; and especially does this
seem to be true of Typhoid fever where the glands in
the mucosa in the region of the ileo. caecal valve
are ulcerated. From this ulcerated surface I
believe the decomposing faecal matter to become
absorbed and account for many of the
symptoms of the Typhoidal state.

It is a recognised fact also that heavy drinkers who suffer much from intestinal disorders dependent on their debauchery, become usually very anaemic. This, I think, in many cases may be accounted for by the solvent action of the unabsorbed Alcohol in the bowel, on its effete contents, and the pernicious action of the latter on the blood capsules when the absorbed products gain the blood.

In Buck's Hygiene. Volume 2 - page 283, Prof. Parrot describes a disease which he calls Atrepsia which seems to me to depend solely on faecal absorption. In it, there is a gradual wasting of the entire organism although food is imbibed as usual, resulting in Emaciation, anaemia & Visceral Steatoses.
Diarrhoea is a prominent Symptom, and the bowel contents themselves are found to give evidence of abnormal putrefactive changes —
Small ulcers and petechiae are found over the intestinal mucosa especially that of the colon. Now, with these local lesions, and the putrefactive changes in the bowel contents, point to absorption of the contents of the colon.
The other Symptoms besides anaemia & denutrition accompanying this disease are: —

Thrush; Erythema; ulcerations of the skin & mucous membranes; otitis interna; Sclerema; coma; convulsions; Tinnitus &c. all of which Ithink, may be accounted for from the state of the blood dependant on the local bowel lesion,

My remarks up till now have been confined to the probabilities of absorption of the ingesta which have and do not undergo decomposition in the bowel usually; but in many cases of intestinal catarrh depending on the retention of fecal matters, the latter undergo a true decomposition (Niemeyer's Practice of Medicine. Vol. i page 543) with the evolution of large quantities of Sulphuretted Hydrogen.
The absorption of this decomposed matter, whether formed in the bowel or swallowed as decomposed food seems to me to cause a kind of septic poisoning which would account for such symptoms as the feverishness — foetid breath — furred tongue and nausea,

B

Besides Anoemia resulting from absorption from the intestinal mucosa, we find numerous cases of Anoemia which can be proved to depend on absorption of faecal gases and other animal effete matters through the lungs, by inhalation.

Persons living in close and ill ventilated houses in our large towns are very subject to Anoemia, which is due to the constant inhalation of the gases produced by decomposition of human excrement, or to the gases from badly ventilated sewers.

The gases constantly inhaled in this manner are Carbonic acid; nitrogen; Sulphuretted Hydrogen (H_2S) Light Carburetted Hydrogen — and Ammonium Sulphide ($(NH_4)_2S$) which account for the headache, Nausea & Anoemia of persons exposed to their influence.

Besides these gases, the decomposition of fasces entered the body generate an organic poison which accounts probably for the Severe Sore throats, diarrhoea, and acute feverish attacks met with in many houses.

Similar Symptoms to the above are not uncommonly noticed in Physician's and Medical Students in the dissecting room from the evolution of similar gases from the bodies, and their absorption into the blood.

There is a great similarity between the general symptoms of most intestinal disorders, and those depending on the absorption of similar gases ~~exists~~ generated outside the organism — Especially is this evident in the state of the blood which gradually loses its red corpuscles —

The only difference, between the two conditions, is I think, that in the one case, absorption takes place through the bowel mucosa, and in the other through the air cells of the lungs — in both instances the gases gain the blood and there act on it —

It is a well known fact, that the Sewage Emanations are known to aggravate the severity of all the Exanthemata;

This I would account for by supposing that the system is much more liable during diseased action to absorption of effete matters, such as faeces —

I have now glanced at the changes of

(a) Anaemia depending on the absorption of effete matter from the intestine

(B) Anaemia depending on absorption of similar substances.

(C) Lastly, I will take up, the action of faecal matter on the blood, after its direct introduction or inoculation into the blood

Summary

C

Effect on the blood of animals, of the injection of faecal matters into it.

Since the winter of 1881 I have frequently experimented on rabbits, with the view of ascertaining what was the result of injecting faeces (freshly passed, and rubbed up with water) into the peritoneum ~~and~~ in small quantities; but I have not been at all satisfied with their results although they have given me great labour and occupied much of my spare time.

Before the faeces had time to decompose, they were rubbed up with distilled water in a clean glass mortar, and then passed through a filter twice, to get a solution as free as possible from solid particles.

With this I filled an ordinary Hypodermic Syringe and injected different quantities of the solution at different times into the peritoneum, allowing the animal more than its usually quantity of food, and free scope to run about in the fresh air. In most of my first experiments I injected 20 minims of the fresh solution twice a day into the animal, for the first day. and afterwards 30 and 60 minims. 3 times a day for a week. The following were the results:—

out of 6 experiments, which I shall mark with the first 6 letters of the Alphabet, respectively.

A. After 3 injections of 20 minims into the peritoneum the animal died a few hours afterwards - presumably from poisoning. On opening into the peritoneum, the injected faecal fluid was found to have remained there, without having been absorbed by the serous surface. No change in the red Corpuscles of the blood.

B. In this case I was able for 5 days to inject the solution into the peritoneum to the amount of 30 minims. On the 2nd day the animal would hardly look at its food, and vomited anything it did take. On the 3rd or 4th day (I forget which) persistent diarrhoea came on which continued now & again until the morning of the 6th day, when on coming to look at the cage I found the rabbit dead.

In this case the faecal fluid seemed, after gaining entrance to the blood, and saturating that liquid, still effected a better, to have been excreted as a poison from the intestinal mucosa. There was no evidence of Enteritis or Peritonitis.

The red blood Corpuscles were markedly reduced in number, and the Haemoglobin diminished in amount, as far as their paler colour indicated me.

C — Half a drachm (a hypodermic Syringe full) of a similar solution was injected in the same way 3 times a day for a week. but gave negative results — the animal continuing to thrive, and the blood discs, to all appearance the same in number, although paler than usual.

D — was treated as above but with a solution stained from a diarhoeic stool, which caused vomiting soon after the second injection, and purging on the 2nd. day — The animal refused all food. and died from starvation on the 3th. day —

The corpuscles were markedly reduced in number and paler than before the injections — The blood had a pungent (not faecal odour)

E — In this case 30 minims of a solution freshly prepared from human faeces was injected into the jugular Vein of a rabbit, through a hypodermic Syringe, thrice a day for several days, and the animal kept on its usual food during the experiments.

Loose motions set in after the 5th injection, but the Animal continued to eat as usual,

In 6 days. the red corpuscles of the blood were diminished in number to a considerable extent, and when we recollect that food was, as far as I could see, absorbed as usual, the diminution must

be regarded as being due to the destructive action of some of the products of the solution, on the blood;

F In this case, the solution was injected into the jugular vein of a rabbit as in the last experiment but no satisfactory results were obtained.

The animal totally refused food, and its cage became soon to ~~was~~ be covered with filth, from persistent diarrhoea. No change in the number of blood discs - and no alteration in the colour of the corpuscles as seen microscopically.

A sewage-like smell was given off from the blood which escaped on opening the abdomen —

As I have said, the experiments just quoted did not give me the good results I anticipated; because the ~~food~~ dislike for food and the attending diarrhoea which occurred in most of the experiments, would be sufficient in themselves to cause a reduction in the number of blood discs after some days of experimentation. There can be little doubt, in my mind that the diarrhoea was really an elimination of the poison in the blood; and I am inclined to regard the diarrhoea of Typhoid and Cholera as ~~being~~ nature's attempt at curing these diseases by getting rid of their respective poisons through the intestinal mucosa. —

The 5th Experiment, is the only one, which seems to point to the probability of the injections being the cause of the anaemia, as food was absorbed by the animal as usual, and no diarrhoea resulted.

When, I have another opportunity however I intend renewing the same experiments, but with this difference, that, instead of a weeks injections I shall continue them for a more lengthened period, in those cases in which the animals continue to eat and pass dung as usual.

I will here mention the results of two simple Experiments which I performed, on a pair of rabbits while on board the S.S. "Clan Sinclair" on my way to Bombay last on November last.
Freshly passed human faeces was rubbed up with an equal quantity of water, and put into an ordinary 2 ounce glass Syringe. A large sized ear Speculum was introduced into the rectum of one of the animals. and kept in position by having two pieces of twine through the holes at the mouth of the Speculum, and secured round the thighs and back. The contents of the Syringe were thrust into the Canula in the rectum, and

on the removal of the Syringe, ~~and~~ the Speculum was tightly plugged with a well fitting cork.
After 3 hours, the Speculum was removed, and the animal allowed to run about an inclosed part of the Engine room—
The same injection was continued ~~for~~ once a day for four days, and the collected urine & some freshly drawn blood examined ~~examined~~ for urea—
In the urine analysis I was unable, strangely, to find any alteration in the quantity of urea; but in the ~~large~~ test tube full of drawn blood I was able to find a decided increase in the amount of urea in the blood by the method introduced by D. Haycraft, one of my predecessors in the Edinburgh Physiological Laboratory—
Exactly 4 drachms of the blood, freshly drawn and defibrinated, were introduced into a small dialyser, which in turn was put into a vessel containing twice the amount of Alcohol, to which the parchment dialyser did blood.
The dialyser was left in this for the greater part of an afternoon (about 4 hours)—
At the end of this time, nothing but a solid mass remained on the dialyser — the urea having passed into the alcoholic solution

This solution I placed in a small porcelain vessel and after adding a few drops of oxalic acid to it, to convert the urea into an oxalate, the fluid was evaporated. After evaporation one could see the urea-oxalate crystals mixed with fat, colouring matter and common salt.

The residue was washed with some petroleum naphtha which dissolved out the latter substances, leaving the oxalate of urea undissolved.

This is next dissolved in water and a little Barium Carbonate solution added to it, and the mixture evaporated to dryness. This dried mass was boiled with alcohol which dissolves the urea, leaving some proteid matters and salt behind; and on evaporating the alcoholic solution, crystals of urea were left on the large watch glass.

Unfortunately, I had no balance, on board ship, but the amount of urea so obtained was at any rate more than twice the amount of the urea in the blood before the experiment.

The other experiment was a failure as the animal died after two days injections; I think the cause of this was the decomposition of the injected faeces - as the injection room was of a very high temperature from the heat entailed by the boilers in the engine room.

There is little doubt, then, but that the injected faeces in these experiments was absorbed into the blood, and from the increase in the urea afterwards, we naturally refer its presence to the effete matters artificially introduced into the blood.

The next point to consider is whether this urea floating in the blood has the power of gradually or quickly destroying the blood corpuscles (red) and thus causing an anaemia; and whether the anaemia depends on the destruction of the red blood discs by any other constituent or derivative of faecal matter.

First — as to the urea being the destructive agent on the red corpuscles:— This we might infer as the effete nitrogenous matters are foreign bodies, so to speak, in the fluid. The urea being small in quantity health, it cannot materially affect the blood but in diseases where the urea is increased it would have a deleterious effect on the corpuscles.

V. Kölliker in the Journal of Microscopical Science vol. 3. page 289, shows us the red blood corpuscles are affected by urea — by repeated injections of this substance, the corpuscles become shrunken and smaller than usual, and the Haemoglobin diminished in amount.

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Secondly:- as to whether the Anoemia might depend on the pernicious influence of any other ingredient (soluble) in the faeces, I am unprepared to say, as it is so difficult to isolate the component parts of faeces one from another; and so ascertain by Experiment.

The foul breath which is so constantly present in digestive disturbances seems to point to some other substance than Urea floating in the blood and given off from that liquid in its passage through the lungs.

Indol. C8 H7 N. to which I have already referred if injected into the Veins of animals, would cause an odor in the breath not unlike that present in Bowel disorders.

The only Experiments I can find on this subject are those of Stich who injected both faecal and putrid Substances into the Veins of animals, with the result that nearly in all cases, the poison was eliminated by the breath and bowel — in the latter case often causing intestinal catarrh.

He makes no reference, however, to any pernicious effect which they may have on the red blood discs.

As to any of the faces of the bowel, that have passed the blood, causing a destruction of red blood discs, there is no evidence -
Carbonic acid - Nitrogen or Hydrogen injected into the blood would not cause anaemia; and the same is true of Sulphuretted Hydrogen which is swallowed in large quantities, by visitors to Sulphur Springs, such as Strathpeffer in our own Country, without any anaemia resulting;

In the human Subject, I have seen cases in which faeces passed by the patient (either a child, or a General Paralytic) have undoubtedly been absorbed into the body, through an abraded or ulcerated surface, from lying in contact with the surface.
In two cases of General Paralysis in men. I have seen ulcers and found enlargement of the Lymphatics in the neighbourhood of the bedsore or ulcer, with anaemia, but I dont wish to attribute to just down the anaemia in these cases to absorption of faeces.
I only state them as further evidence that faeces may be absorbed by the person who passed them after their exit from the body.
In ulcerated surfaces inside the body, I need only

cite the case of Typhoid fever where the ulcerated condition of the solitary glands and Peyer's Patches puts the faecal matter lying over them, in direct communication with the lymphatics of the mucosa and bloodvessels — and thus faecal absorption I think many of the typhoidal symptoms are due,

Lastly, faecal matter may gain entrance to the body by being dissolved in & mixed with drinking water. In these cases we find Anaemia, (especially if the case is a long continued one), lassitude, anorexia, headache — sometimes sore throat & purging — the latter being probably nature's attempt at a cure by eliminating the absorbed poison.

The treatment which I find most valuable in Anaemia where there is persistent intestinal disorder, especially in Chronic Constipation is an aperient dose of the Carbonate of Iron — not only is the good effect of the Iron obtained by absorption, but the preparation seems to have a tonic action on the intestinal mucosa and thus preventing the passage of faeces in solution into it. and thus into the blood ——

In conclusion, I trust the Senates will overlook the many imperfections of this Thesis – as the subject is not only a most disagreeable one, when the Experimental side is taken into consideration, but also a difficult one, as no man can actually demonstrate that this absorption really does take place.
As I have already said, I cannot see that it is at all improbable that this absorption can take place, and for no other reason it will give me satisfaction that the subject has been put before the Faculty so that we may benefit from the opinions of others, hereafter.

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