

breadth of body must be the chief cause of separation of the branches of the aorta and of the presence of common iliac arteries.

The obturator artery is very often a branch of the internal circumflex in monkeys, and this usually comes from the internal iliac in these animals; lower down in the scale the obturator is often wanting, but in the monotremes it forms a rete. The internal pudic artery often rises from the sciatic trunk outside the pelvis; it is wanting in the hedgehog and the lemur, but in these specimens, both of which were females, the dorsalis clitoridis came from the vaginal and represented the occasional accessory pudic of man. It seems probable that the internal pudic was originally an extra-pelvic branch of the sciatic to the cloacal region.

The sciatic is the original main blood-path of the hind-limb. In the lizard the positions of the brachial and sciatic are quite similar, both of them running along the post-axial surface of the limb. In mammals, where the thighs become adducted and internally rotated the blood makes a new and shorter channel on the inner side of the thigh from the external iliac and deep epigastric which are present in the reptile. In man this main sciatic trunk is occasionally reverted to, but I have never seen it in any other mammal. Probably the position of man's thighs would render the reappearance of this artery easier than it would be in other mammals.

With regard to the branches of the external iliac, the deep epigastric is constant in position, and in the Capuchin monkey (two specimens) it gave off the obturator artery, so that this important human abnormality is probably atavistic. The deep circumflex iliac, on the other hand, has in man shifted its origin from much higher up; in the Carnivora, for instance, it rises from the hinder part of the aorta.

The femoral artery forms a rete mirabile in the sloths and ornithorhynchus; its division into superficial and deep is not very satisfactory below the Primates. Among its branches the superficial epigastric is the artery of the inguinal and posterior abdominal mammary glands. The internal circumflex is nearer the pelvis and larger than in man; it often in Old World monkeys rises from the internal circumflex in the pelvis and supplies the same area as in man as well as the hamstrings; its origin is always higher than that of the external circumflex. The internal saphenous artery carries the blood to the foot in almost all mammals until man is reached and then it is only represented by the anastomotica magna. In its full development it accompanies the internal saphenous vein and nerve along the posterior margin of the tibia to about the middle, where it divides into two, one for the dorsum of the foot, the other for the sole. The dorsal branch behaves just as the dorsal artery of the hand does, dividing into dorsal, interosseous, and perforating branches, from the latter of which the deep plantar arch is formed in man. This dorsal branch clearly corresponds to the radial in the fore-limb, running as it does along the pre-axial border of the limb to the dorsum. The plantar branch divides into digital branches for the toes and lies between the long flexor tendons and the flexor brevis digitorum; its serial homologue in the forelimb is probably the superficialis volæ. Very often the dorsal branch of the saphena is absent and then the dorsum of the foot is supplied by the anterior tibial which is probably an older blood-path, as it is found in the lizard closely corresponding with the vascular arrangement of the anterior interosseous in the fore-arm. When the dorsal branch of the saphena is well developed it carries the blood to the dorsum and the anterior tibial becomes a mere muscular branch to the extensor muscles, its anterior tibial recurrent branch probably corresponding to the posterior interosseous and posterior interosseous recurrent of the forearm. In man the straightening of the knee has caused the blood to revert to its ancestral path to the dorsum through the anterior tibial. Another marked change which comes over the anterior tibial artery is its relation to the popliteus. In all mammals until the Primates are reached the artery invariably passes in front of the popliteus, but in the lemur the popliteal artery runs behind the muscle and the anterior tibial passes through the membrane beneath the lower border of it, and this arrangement continues until man is reached. The former, more generalised, mammalian arrangement is sometimes found as a human abnormality (twice in 106 cases in the report of the English Collective Investigation Committee).

The posterior tibial artery is a muscular branch running

down between the two layers of flexor muscles and clearly corresponding with the median in the forearm. In man, when the saphenous artery disappears, the posterior tibial carries the blood to the sole.

The peroneal artery is not well marked until man is reached; its position on the post-axial side of the flexor surface of the leg suggests that it is possibly homologous with the ulnar in the forearm.

It is interesting to note that although the two limbs start with an identical arrangement of vessels in the lizard, they are modified in a different order in the mammalia; the fore-limb first adopts a median ventral vessel, the median, to carry the blood to the hand, while the hind-limb sends its blood through a pre-axial vessel—the saphenous. Later, in man, with the assumption of the erect position, the systems are reversed and in the leg the median ventral vessel (posterior tibial) carries the blood to the sole, while in the fore-arm this vessel is done away with and two lateral vessels, the radial and the ulnar, are used. At the same time in the leg the old anterior tibial blood-path of the lizard is reopened on the extensor side of the leg. These changes point to the ready adaptability of arteries to change of environment.

A CONTRIBUTION TO THE STUDY OF INTESTINAL SAND,

WITH NOTES ON A CASE IN WHICH IT WAS PASSED.¹

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THE occurrence of intestinal sand has attracted the attention of observers for some years past. Cases presenting this symptom appear to have been of singular infrequency in the British Isles, for it is scarcely possible that they can have been often overlooked. English literature on the subject is, however, almost a blank, and the best text-books in this country and in the United States of America make but little reference to it. A good many cases have been noted and reported on the continent of Europe. The object of this communication is to attempt to place these examples of intestinal sand in their proper nosological position and to record a case of true, as distinguished from false, enteric lithiasis which came under our observation in this country. The particulars of it are as follows.

A married lady, aged 33 years, residing in the provinces, and leading a healthy life, began to suffer from diarrhoea early in 1900 and came under the care of Dr. E. Surridge. No cause for this ailment was made out. The previous health had always been fairly good. The last confinement had occurred three years before. The house which was occupied by this lady was built on a sandy soil and its drainage was reported to be in excellent condition and of recent arrangement. The water-supply was not good, being hard, and containing some organic impurities. The family history was as follows. Both parents were living. The father was a gouty man and a brother and sister of his were gouty. There were five sisters and two brothers; one of the latter suffered from colic. Bowel disorders were said to be prevalent in the family. The youngest sister of the patient, 20 years her junior, suffered badly at one time from a widespread eczema. When this disorder was subdued she suffered from asthma, the two conditions alternating. After local treatment and internal medication with arsenic she recovered her health. The patient had two daughters, aged respectively seven and three years, both of whom were in good health. After the last confinement the patient suffered occasionally from eczema around the anus for about 18 months. When this condition yielded to local and general treatment she became subject to looseness of the bowels, having previously been of

¹ A paper read before the Royal Medical and Chirurgical Society.

a constipated habit. Her weight in the summer of 1899 was 9 stones 2 pounds. The present ailment began in January, 1900, with a very intractable diarrhoea, accompanied with internal rumbling and purring noises, there being six or eight loose motions in each 24 hours. In the middle of February the patient took to her bed and was ordered an exclusively milk diet with lime-water. This treatment lessened the diarrhoea to three or four motions each day, sometimes attended with the passage of mucus. On March 8th she was seen in consultation with Dr. Harris of Manchester. 10 days later sand was discovered in the motions and found subsequently in all in which it was looked for.

On March 23rd, in Dr. Harris's absence, Dr. J. Dreschfeld's opinion was taken on the case. No ordinary methods of treatment had any effect in checking the diarrhoea and the formation of intestinal sand. The patient was sent up to London in April, and in Sir Dyce Duckworth's absence from town came under the care of Dr. A. E. Garrod. At this time two or three motions were passed each day. They were loose, brown in colour, and on tilting the bed-pan the gritty sand could be seen at the bottom of the vessel, each motion containing about a teaspoonful of it. Early in May Sir Dyce Duckworth saw the patient with Dr. Garrod. She was pallid and sparsely nourished. The thoracic organs were healthy. On examining the abdomen it was found that the colon and its sigmoid flexure were, though empty, too readily palpable, and apparently thickened in their walls. The right kidney was moveable. There was a slight degree of pyrexia at this period, the temperature rising occasionally to 100° F. or a little above this. Specimens of the sand were obtained and submitted to examination. Full details of this are furnished in Dr. Garrod's report herewith. It will suffice to say here that it much resembled at first sight a deposit of uric acid, being of reddish-brown colour and finely gritty. It was insoluble in cold and boiling liquor potassæ and readily soluble in boiling nitric acid. Under a low power of the microscope particles of various shapes and sizes were seen, of a brilliant reddish-brown hue, and translucent.

The patient was confined to bed and kept on milk diet. For medicine salicylate of bismuth and bicarbonate of sodium were given in mixture. Under this treatment the diarrhoea was somewhat checked and the general health improved. The motions were rather more consistent, stained by the bismuth, but still contained sand. Towards the end of May the patient sat up for some time daily and went out for short walks, but there was now complaint for the first time of pain in the large bowel. Chicken broth, turtle soup, mutton broth, and koumiss were now given, and a mixture containing carbonate of bismuth, opium, and tincture of cinnamon. There were gradual improvement in most respects and less pain, but a good deal of rumbling noise in the bowels. The patient returned home early in June and continued the treatment under Dr. Surridge's care. Some benefit was gained by taking bael jelly and also from a mixture containing some aromatic sulphuric acid, tincture of cinnamon, and opium. In July, by our advice, she went to Plombières under the care of Dr. Bottentuit. She took baths and had rectal douches and drank the water in small quantities. All vegetable food was withheld, and digestion was found to be much more comfortable without it, as it caused immediate distension. She lost 10 pounds in weight while at Plombières. The next month was spent in Folkestone with some benefit and some weight was regained. On her return home she reported herself very much better. Her general health and her nervous tone had improved. There were still diarrhoea, with much flatulence at intervals, and some, though less, sand, accompanied with a great deal of mucus. Dr. Bottentuit prescribed bicarbonate of sodium in teaspoonful doses with advantage for the flatulent attacks. The appetite was better and more variety of food could be borne. During October there were alternations of constipation and diarrhoea, and a considerable quantity of sand was passed on Oct. 12th. She was next seen in November. She was rather pallid and languid, was easily tired on exertion, but had regained her usual weight, 9 stone 2 pounds. The large bowel no longer appeared thickened, as it did six months previously, but there was tenderness on pressure about the splenic flexure of it. There was still a looseness of the bowel, from two to four actions occurring daily, but no sand was passed. Her diet was altogether of animal food, and a little whisky was taken

with one meal. The urine was turbid with lithates and deposited uric acid. The tongue was large, flabby, and thinly grooved. A mixture with liquid extracts of cinchona and bael and tincture of cinnamon was ordered, and milk with natural seltzer water was added to her diet. The catamenia were regular. She returned home about the middle of the month.

This case presented most of the characters that have been described in the few instances of the disorder that are already on record. It was, however, remarkable for the little pain which was experienced. In most examples of enteric lithiasis this appears to be a marked feature, occurring in paroxysms lasting several hours, somewhat akin to those associated with biliary and renal colic and attended with much flatulent distension and vomiting. According to M. Dieulafoy, who has recorded a series of these cases, there is commonly a family history of gout, and he regards the condition as one of the irregular manifestations of this disorder in many, but not in all, instances. In this case there was a distinct gouty history on the father's side. In a large proportion of the recorded cases there has been noted the co-existence of muco-colitis, often attended with the passage of mucous casts and sheds. Diarrhoea occurs in some cases, and constipation in others. The subjects of the disorder in two-thirds of the cases have been women, and the average age is about 35 years. Examples of it have been recorded in children under four years of age. Some of the cases described by continental observers, as will appear from Dr. Garrod's inquiries, are not truly cases of enteric lithiasis such as here described, the so-called sand having been proved to consist of vegetable débris and not of inorganic matter.

Characters and composition of the intestinal sand.—When washed and dried in the air the gritty material passed with the motions had the appearance of a fine sand. Its ground colour was a deep brown with an admixture of pale or almost colourless particles. Under a low power of the microscope the individual granules were seen to have a great variety of shapes; some were roughly oval, some oblong or even rod-like, and others, again, were of very irregular outline. Their colour varied from yellow to a warm brown. Some were translucent and others opaque, with the exception of their edges. Some had a finely granular appearance, but none of them showed any indication of crystalline structure. Their longest measurement varied between 0.05 and 0.2 millimetres. When treated with an acid beneath a cover-glass the particles became surrounded by groups of bubbles and the solution of the inorganic constituents left exposed an organic basis, brown in colour, wholly structureless, and soluble in alkalis. No cellular elements could be seen and the organic basis certainly did not consist of vegetable débris of any kind. As in Eichhorst's case, the organic material, when washed with distilled water and stained with methylene blue, was seen to be rich in bacteria, both bacilli and micrococci being present in large numbers. When, on the other hand, the organic material was got rid of by combustion, the particles of inorganic substance left appeared like decolorised shadows of the original granules, which they resembled both in shape and size. The air-dried sand lost considerably in weight at 100° C., owing to the expulsion of water from the organic basis, and the percentages of water and of organic and inorganic materials contained in it were found to be as follows:—

Water	...	...	...	...	...	...	...	...	12.40
Organic material	...	...	...	...	...	...	...	...	26.29
Inorganic material	...	...	...	...	...	...	...	...	61.31
									100.00

The inorganic residue left after combustion over a Bunsen's burner had a bluish-white tint and contained only a few dark particles. With the exception of such particles it was completely soluble in hydrochloric acid. This residue was submitted to analysis and was found to have the following composition:—

Calcium oxide (CaO)	...	...	...	...	...	...	...	...	54.98
Phosphorus pentoxide (P ₂ O ₅)	...	...	...	...	...	...	...	...	42.35
Carbon dioxide (CO ₂)	...	...	...	...	...	...	...	...	2.20
Residue, containing traces of magnesium and iron	...	...	...	...	...	...	...	...	0.47
									100.00

The presence of magnesium was beyond doubt, but the quantity was extremely small. Calcium phosphate was clearly the chief mineral constituent. The pigmentation of the sand proved to be somewhat complex and the small

remainder of the material available did not permit of a complete and satisfactory investigation from this point of view. When some of the material was treated with acetic acid a scanty evolution of carbon dioxide was observed, and the gas rose to the surface in a stream of minute bubbles. The solution had the colour of brown sherry, and when filtered from the organic debris and shaken with ether it imparted to the ether a delicate pink tint, whereas the sub-jacent liquid remained of a rich yellow colour. The extraction was repeated several times, and the collected ethereal extracts were next shaken with a small quantity of distilled water, whereupon the pigment left the ether and imparted to the water a rich pink tint, which recalled that of a solution of acid hæmato-porphyrin. When examined with the spectroscope this solution showed a broad absorption-band in the neighbour-hood of the D line, which lay between $\lambda 6120$ and $\lambda 5370$. With hydrochloric acid solutions of the pigment the band appeared composite, consisting of two darker bands united by a dark shading, and the position of the component parts was approximately as follows:—

First dark band	... ..	$\lambda 6120$ — $\lambda 5890$
Dark shading.		
Second dark band	... ..	$\lambda 5760$ — $\lambda 5460$

A second band in the neighbourhood of the F line ($\lambda 5060$ — $\lambda 4860$) corresponded in position with that shown by a dilute acid solution of urobilin, and was apparently due to a scanty admixture of that pigment. When kept for a day or two, even in the dark, the pink solution became almost de-colourised and the urobilin band alone remained visible. The pink pigment was also promptly decolourised by alkalis. The very unstable pink colouring matter here present did not agree in its properties with any pigment, fæcal or other, with which we are acquainted. The yellow liquid from which the pink pigment had been extracted with ether showed the band of acid urobilin with great intensity, and urobilin was apparently the chief colouring matter of the sand. It had all the ordinary properties of urobilin, as obtained from urine or fæces; was precipitated by saturation of a watery solution with ammonium sulphate; yielded a green fluores-cence with zinc chloride and ammonia, and showed the characteristic E-band spectrum when partially precipitated from a concentrated alkaline solution by the cautious addition of an acid. The organic residue upon the filter-paper acquired a green tint on exposure to air, and when treated with a solution of sodium hydrate yielded a pale greenish-yellow solution, which did not become more distinctly green on standing but which gave Gmelin's reaction. Hence it was evident that among the colouring matters present was a small quantity of unaltered bile-pigment. Berlioz mentions the presence of urobilin in one of Dieulafoy's specimens, and Eichhorst observed the presence of biliverdin in some granules of the sand which he examined; but the only recorded case in which a special investigation of the contained pigments has been carried out is that of Dr. R. S. Thomson and Dr. A. R. Ferguson, who found, in addition to some urobilin, a pigment soluble in dilute hydro-chloric acid and in alkalis but insoluble in water, alcohol, ether, and chloroform, and which was obviously not one of the recognised colouring matters of the bile.

We are greatly indebted to Dr. Thomson and Dr. Ferguson for the opportunity of examining a small quantity of the sand in question, which in appearance chiefly differs from ours in the larger size of the component granules. From a solution in acetic acid there was not extracted by shaking with ether any of the unstable pink pigment above described, and judging by the intensity of the absorption-band the amount of urobilin present appeared to be considerably less than in our specimens.

VARIETIES OF INTESTINAL SAND.

Although the literature of intestinal sand is so scanty two distinct classes of materials have clearly been described by this name. These require to be clearly distinguished from each other and they may conveniently be described as *true* and *false* sand respectively.

1. *False* intestinal sand is composed of remains of vege-table foods which have resisted the action of the digestive fluids and which may or may not have acquired some incrustation of earthy salts. One particular kind of vege-table debris is especially apt to appear as a sand-like material in the motions—namely, the sclerenchymatous particles which are so abundantly present in the flesh of

pears, and especially in that of certain varieties. The occurrence of such sand in the motions was described by C. Robin in 1873, and some at least of the specimens described by Laboulbène in the same year were obviously of this nature. Eichhorst described a case in 1889, and Fürbringer called special attention to this material as simulating biliary concretions. Naunyn also refers to it as one of the varieties of so-called "biliary sand."² In this country specimens of this kind have been brought before the notice of the Pathological Society of London by Dr. S. Delépine and Mr. S. G. Shattock. A specimen of pear sand in our possession, for which we are indebted to the kind-ness of Dr. J. H. Drysdale, is paler in colour and more coarsely granular (from 0.3 to 0.6 millimetres) than that passed by our patient and when burnt leaves only 1.76 per cent. of inorganic residue. Other observers have obtained from 2 to 3 per cent. of such residue—figures which con-trast sharply with the much higher percentage of mineral constituents in specimens of true intestinal sand. The microscopic appearance of the *pear* sand is very charac-teristic. When examined under a low power the granules appear as if studded with projecting crystals, and after removal of any inorganic incrustation by an acid they are seen to be composed of woody cells, the thick, transparent walls of which are traversed by channels running from the narrow cell cavities towards the surface. In a word, the granules are easily recognised as identical with the particles of sclerenchymatous tissue in the fruit from which they are derived, and of which the patient will be found to have partaken freely. There is reason to believe that these woody particles may remain for some time in the intestine, and the expulsion of large accumulations of them may be preceded by severe colicky pain. The presence of a black sand-like material in the motions, consisting of cells derived from the banana, has also been described by some American authors. The dark colour is apparently acquired during the passage of the cells along the alimentary canal.

2. *True* intestinal sand, on the other hand, of which the material passed by our patient offers an example, has no such vegetable basis, and, wanting such a rigid skeleton, it owes its hardness and grittiness to the much larger proportion of inorganic material which it contains. The organic basis of such sand is clearly of animal origin. Some of the published analyses of such materials show a very close resemblance to that of our specimen. Thus Mathieu and Richaud analysed the sand passed by their two patients with the following results:—

	Case I.	Case II.
Organic material	30.800	45.80
Tricalcic phosphate	64.206	46.68
Calcic carbonate	3.418	5.14
Various mineral substances	1.576	2.38
	100.000	100.00

Dr. Thomson and Dr. Ferguson's specimen had the follow-ing composition:—

Organic matter	28.5
Inorganic matter	71.5
	100.0
In the organic residue:	
Calcic carbonate	11.7
Tricalcic phosphate	87.3
Insoluble residue (silica)	1.0
	100.0

Berlioz analysed one of Dieulafoy's specimens and obtained the following figures:—

Water	11.25
Nitrogenous organic material of fæcal origin	22.24
Fatty substances	Traces
Phosphoric acid	17.56
Lime	26.22
Magnesia	14.05
Silica	8.68
	100.00

² Since this communication was made we have found a description of the pear sand by Dr. Alexander Marcet, in his "Essay on Calculous Disorders" (p. 132), published in 1817. The description was based upon specimens the true nature of which had been recognised by Wollaston.

In some other cases the proportion of inorganic material has been considerably less. Thus Marquez found:—

Organic matter, of animal origin	72
Inorganic, consisting of calcium phosphate and traces of carbonate	28
	100

In a case recorded by Biaggi the sand was agglutinated into balls, from 6 to 8 centimetres in diameter, which readily disintegrated into sand. Much calcium phosphate was present, with traces of magnesium and sodium. The material passed in Mongour's case was *gravel* rather than *sand*, and it occupies an intermediate place between intestinal sand and the large intestinal calculi which are sometimes met with, and which are usually composed, in large part, of ammonium magnesium phosphate. Most of the particles were of about the size of an orange pip, but some attained to the dimensions of nuts. The analysis was as follows:—

Organic material (by difference), water, iron	29.28
Magnesium phosphate	26.82
Calcium carbonate	43.90
	100.00

Seat of formation of "true" intestinal sand.—The question remains to be considered how and where sand of this description is formed. Its composition excludes a biliary origin, for it contains no cholesterin, and bile pigment is only present in traces. On the other hand, there is much that points to its origin in the intestinal tract. Such sand is practically always met with in association with intestinal disorders and usually with muco-membranous colitis. The characters of the organic basis and the large numbers of bacteria which are included in it point to the intestine as the most likely seat of origin. When our patient was taking bismuth salicylates the sand passed had a uniform grey tint, but this may have been due to the deposition of a mere surface coating of bismuth sulphide. The richness of the material in urobilin and its poverty in unaltered bile-pigment affords a more satisfactory indication, and suggests that it is formed in a region in which the conversion of the bile-pigment into urobilin is already far advanced. There is good reason to believe that the principal seat of this change is in the upper regions of the colon. Concretions, chiefly composed of calcium phosphate and carbonate, can hardly be formed in any but alkaline surroundings; but there is so much doubt as to the reaction of the contents of different parts of the intestinal tract, and especially under morbid conditions, that this does not afford any very clear indication of the exact locality in which the sand is formed. The nature of the inorganic constituents is fully compatible with an intestinal origin. Nor is it necessary to look to unabsorbed residues of the calcium of the food as the sole source of supply, for Voit, Friedrich Müller, and von Limberg have shown that a large part of the calcium excretion of the body is effected by the intestine, and Kobert and Koch found calcium, magnesium, and phosphoric acid in the material which accumulated in the empty and cleansed colon of a patient with a fæcal fistula. Like Dr. Thomson and Dr. Ferguson's patient, ours had taken milk and lime-water freely, and, as Bunge has shown, the amount of lime contained in milk is actually greater than that present in an equal volume of lime-water, so that the former may be regarded as a more important source of calcium supply than the latter.

The above considerations leave little room for doubt that true intestinal sand has its origin in the intestinal canal, for chemical and clinical evidence alike point in this direction. The nature of the contained pigments suggests the colon as the most likely seat of formation and the anatomical structure of the large bowel may be looked upon as more favourable than that of the small intestine to the sojourn required for the deposition of the earthy salts of which the material is so largely composed.

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SOME EXPERIMENTS TO DETERMINE THE ACTUAL EFFICACY OF IZAL OIL AS AN INTESTINAL DISINFECTANT.

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BRILLIANT as are the results that have followed the employment of antiseptics in modern surgery, there is reason to believe that a limit to the scope of the antiseptic method both in preventing and in subduing disease has by no means yet been attained. The success of preventive medicine is witness to the utility of the same principle in another field. But the application of antiseptics in medicine proper—i.e., in curative as distinct from preventive medicine—is, owing to the lack of accurate practical knowledge no less than to the difficulties involved, at present comparatively restricted. Few subjects, however, are more worthy of careful study than the problem of the more skilful employment of antiseptics in medicine; and this is my excuse for publishing the result of some experiments made with the object of determining the actual value of an intestinal antiseptic.

Izal oil, which is, unfortunately, a proprietary article, was discovered by Mr. J. H. Worrall while investigating by-products met with during the conversion of coal into coke. We are told that it consists chemically of oxidised hydrocarbons having a larger proportion of hydrogen to carbon than the members of the phenol (C_6H_6O) series and a less proportion than the members of the methyl alcohol (CH_4O) series. It has a high boiling point and is insoluble in water. The main preparations are (1) izal oil; (2) an emulsion containing 40 per cent. of the oil and termed "medical izal"; and (3) ordinary izal fluid which is also an emulsion containing 40 per cent. of the izal oil, but not in this case, as in that of the medical izal, specially refined.

The extensive tests made by Dr. Klein¹ with regard to the germicidal properties of izal showed that while ordinary izal emulsion diluted to the extent of 1 in 200 is a disinfectant *in vitro* of no mean power, its toxicity was low, doses of 0.25 cubic centimetre of a 1 in 100 dilution administered to rabbits either by the mouth or subcutaneously producing no detrimental effect of any kind. The experiments of Professor Sheridan Delépine² supplemented those of Dr. Klein and confirmed the conclusion as to the value of izal as a disinfectant *in vitro*.

The history of the use of izal as a germicide *in vivo* is as follows. In consequence of Dr. Klein's results Mr. W. Bruce Clarke³ thoroughly tested the efficiency of izal as a

¹ Report on the Disinfecting Properties of Izal.

² Ibid.

³ THE LANCET, July 1st, 1893, p. 18, and St. Bartholomew's Hospital Journal, September, 1894.