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Beedings,
Pulborough,
Sussex.

25 Jan.y 1921.

Dear Sir Dyce Duckworth

I send this vol: of some of my medical work to you at the Roy. Col. Phys for presentation to the Coll, if they will do me the honor of accepting it.

I take the liberty of making you a "go between" in order that, if you do not approve of its insertion, you may return a letter of yours to me, dated some 42 yrs ago!

I had thought the autographs of some of our eminent associates of days long past might give an interest & some flavour to my dull book, so included them with other letters which bear a bearing on the subjects treated of.

Amongst a miscellany of papers, I have included my Lumleian Lectures which I deferred printing at the time, thinking to supplement them with a critical review of the "Germ theory". But this "Light-hearted, insatiable Cormorant", spread abroad too quickly, & found the pace too fast for my leisure, & I said "let it rest"

journey upon itself" what think you?

As to ourselves, we must both acknowledge a good share of time, even to old age: may it prove a pleasant part of life's journey to you, & if it should be sometimes a little "frosty", may it be ever "kindly" to you!

Believe me, dear Sir Dyer,

Sincerely yours,

John Hartley.

HARLEY, John

Contributions to Medical

Science.

61(04)

239/0

ON THE

ENDEMIC HÆMATURIA

OF THE

CAPE OF GOOD HOPE.

BY

JOHN HARLEY, M.D. Lond., M.R.C.P., F.L.S.,

ASSISTANT-PHYSICIAN TO KING'S COLLEGE HOSPITAL, AND TO THE LONDON FEVER HOSPITAL.

COMMUNICATED BY

DR. LIONEL S. BEALE.

[*From Volume XLVII of the 'Medico-Chirurgical Transactions,' published by the Royal Medical and Chirurgical Society of London.*]

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1864.

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Received Dec. 26th, 1863.—Read Jan. 26th, 1864.

Endemic hæmaturia is a disease indigenous to hot countries. In these temperate regions we are, happily for us, altogether free from it. Medically speaking, there is but one drawback to this immunity—we are almost entirely precluded from searching into its cause and pathology. When, therefore, a case of endemic hæmaturia comes under our observation, it cannot fail to excite our interest and engage our careful attention.

Three months ago, a robust gentleman, between twenty and thirty years of age, a resident of the Cape of Good Hope, consulted me about a slight ailment. On his second visit he mentioned incidentally that for several years past he had frequently passed a little blood with the urine. He said this disease was very common in the Cape, in some parts of

which both men and women suffered from it. He mentioned Uitenhage as being a place in which it was particularly prevalent. It was commonly supposed there to be a gravel complaint, caused by drinking the water, which, he informed me, was derived from a good clear spring, arising nine or ten miles distant, in Winterhoek Mountain, and conveyed, partly through bush, in an open channel cut in the red ferruginous clay. The water thus brought to the town is distributed through the streets in open gutters, which are paved in some parts, but in others the bed is alluvial, and allows of the growth of numerous water plants. The drinking-water of Uitenhage is obtained from these gutters; horses and other animals have ready access to them, and by means of diverticula, the gardens are watered from them.

Having described to me the symptoms of his disorder, which I have detailed below, I requested him to send me some of his urine for examination, and while I was awaiting its arrival I made some further inquiries from my Cape friends and acquaintance concerning the hæmaturia of this part. Messrs. Edwin and G. D. Atherstone and Mr. Walter Mills corroborated the statements of my patient. Those of their schoolfellows, they told me, who came from Uitenhage all voided blood in the urine; it was a common complaint there, and was supposed to be caused by drinking the sandy water which flows through the streets.

From the foregoing evidence it is clear that there exists in some parts of the Cape an endemic hæmaturia, the cause of which is at present unknown.

Thirty degrees east of Uitenhage, and ten degrees nearer the equator, in Mauritius, hæmaturia is known to be endemic. Chapotin,[1] Salesse,[2] and Rayer,[3] have each recorded several cases of the disease existent in the Isle of France. Dr. Todd, in his work on 'Urinary Diseases,'

[1] Chapotin, Ch., 'Topographie médicale de l'Ile-de-France,' in-4, Paris, 1812.

[2] Salesse, Antoine-Emilien, 'Diss. sur l'hæmaturie ou pissement de sang,' in-4, Paris, 1834.

[3] Rayer, 'Maladies des Reins,' vol. iii.

page 62, makes the latest mention of it; he says, "Hæmaturia is so common in the Isle of France that few, I am informed, of the male population escape it." One young man, who had resided there for five years, came under his treatment for the disease. "The blood was always small in quantity, never so much as to discolour the great bulk of the urine; it came with the last portion only, quite at the end of micturition, a few drops of apparently pure blood escaping at the last. Sometimes small clots were discharged, without any definite shape. After standing, the urine would deposit a sediment of a whitish or reddish mucus, composed of bladder-epithelium, crystals of oxalate of lime, and a few small cells, which presented all the microscopical characters and actions of those of pus- and blood-corpuscles. There was no appearance of casts of tubes or of renal epithelium. The source of the hæmorrhage," he continues to say, "was doubtless the bladder, and the disease seemed to be essentially a catarrh of that organ, with occasional hæmorrhage."

I will now enter into the details of the case which has come under my own observation.

Previous history.—About four and a half years ago my patient had the "low fever" of the Cape, and afterwards took a journey to Japan to recruit his health. He remained in this island three weeks, and dwelt during the whole of the time at Nagasaki. The drinking-water, he remarked, was dirty and disagreeable. A fortnight after leaving Japan, and while on board ship, he first noticed symptoms of hæmaturia. On his homeward journey he visited China, and remained there six weeks.

Symptoms.—The first indication of the disease was the passage of a little blood after emptying the bladder of clear urine; the blood was dark coloured, and amounted usually to a few drops; it never exceeded a teaspoonful. For the first fortnight it appeared after every act of micturition; it has continued, with weekly or fortnightly intermissions, ever since—a period of about four years. Unusual exercise and railway travelling always cause a slight increase in the quantity of the blood. For the last year the bleeding has

been frequently substituted by the passage of soft but consistent filaments, irregularly cylindrical, sometimes nearly colourless, but usually deeply blood-stained. They occasionally interrupt the flow of urine for ten or twelve minutes, but are then voided, and the obstruction is removed. Excepting the last table-spoonful, the urine itself is never coloured by blood. During the last few months, and when in a state of quietude, these red threads, or "veins," as he calls them, have altogether taken the place of blood. There is no increased frequency of micturition, no irritability of the bladder, but the desire to micturate is a little stronger than usual, and generally requires immediate attention. The quantity of urine voided is natural. There is no tenderness in the pubic or lumbar regions, but a sudden and sharp twinge of pain is occasionally experienced in the loins, such as, if it come on during a walk, necessitates a halt for a few minutes. It subsides as suddenly. The complaint causes but little annoyance, and the health is otherwise very good. He was travelling in company with a gentleman resident in Uitenhage, who was then suffering from precisely similar symptoms.

Condition of the urine.—In the early part of October, 1863, I received six ounces, which, on rising in the morning, had been passed directly into a clean bottle. Pale-amber coloured, specific gravity 1017·6, acid, deposits a deep layer of dirtyish-white flocculent matter, amongst which were two short opaque filaments about the $\frac{1}{35}$ of an inch in diameter, of a brownish colour and soft consistence, two shorter and wider fragments of the same substance, a little reddish mass the size of a hemp-seed, like a little clot of blood, and numerous white specks. The clear limpid urine, when acidulated with HO,NO_5 and heated, deposited a trace of albumen.

The secretion was examined from time to time, and presented little or no variation. It was usually pale and whey-like, deposited the flocculent matter, furnished a trace of albumen, and contained the filamentous bodies and specks. Sometimes the specimen was loaded with

fine crystals of uric acid and urates; oxalate of lime was never altogether absent—in most samples it was abundant; sometimes there was a little blood-stained, slimy mucus.

Abnormal constituents of the urine.—Except the albumen and crystalline deposits above mentioned, these were composed of pus-corpuscles, which, with the fine amorphous deposit of oxalates, formed the flocculent matter, a few blood-corpuscles; and the filamentous bodies and coagula. It is these latter which will now engage our attention. Examined under a half-inch object-glass, they were found to be composed of round or flattened, often branched masses of mucous cells and soft molecular mucous fibres, forming together a firm coherent matrix, more or less stained with blood, and imbedding a variable number—sometimes three or four, sometimes thirty or forty or more—bright, highly refractive, oval bodies (Plate II, fig. 2), which I had no difficulty in recognising as the ova of some entozoon. The mucous casts were sometimes dirty white, and composed wholly of mucus; sometimes they contained a considerable number of red blood-corpuscles. They varied much in diameter, the smallest measuring about the $\frac{1}{500}$ of an inch. The larger were generally flattened, the smaller were cylindrical. *a*, Fig. 1, are all the filaments and coagula which were contained in one sample of urine; *b*, Fig. 1, all those from another.

Ova.—Composed of the immature embryo contained in the egg-case, elongo-ovate, $\frac{1}{170}$ inch in length, $\frac{1}{400}$ inch wide, being about the same size as the advanced eggs of the cheese mite (*Acarus domesticus*); anterior extremity acuminate. Spine $\frac{1}{6000}$ inch long, sometimes straight (Fig. 6), sometimes deflexed (Figs. 7 and 12), the base usually confused with the rest of the egg-case (Fig. 6), sometimes abrupt. Egg-case a bright hyaline, chitinous envelope, unaffected by alkalies and acids, the $\frac{1}{10000}$ of an inch thick, presenting a double contour line, and dehiscing longitudinally (Figs. 4, 8). Contents enclosed in a distinct vitelline membrane, and composed of a solid mass of clear spherules and granules (Figs. 3, 7, &c.). The former average the $\frac{1}{4500}$ of an inch in diameter. The largest are usually aggregated about the

centre and anterior extremity of the embryo mass. After maceration in water slightly acidulated with HCl, the albuminous constituents appear to be dissolved and the interior resolved into a mass of strongly refractive spherules of fatty matter (Figs. 8 and 9). Generally no organs can be distinguished. Fig. 6 represents the nearest approach to organization that I have observed. In this ovum the anterior extremity of the embryo mass forms a papillary projection, and there is an appearance of lines and of two little pyriform bodies converging to it. Here and there a minute cell or two is observed to lie between the egg-case and the investing membrane of the embryo. Sometimes the ova are much elongated, and when this is the case they either remain straight or become elegantly curved, their opposite extremities being waved in different directions (Fig. 12).

In one branched mass of mucus the ova appeared to be in a more advanced stage of development, the ovisacs dehiscing very readily on pressure, and liberating the immature embryo, as is represented in Fig. 4. It is broader and less symmetrical than the egg-case, is attenuated at one end, but as yet there is no apparent differentiation into distinct organs. Numerous dehisced and empty egg-cases lay in the mucus.

Mature embryo.—Outside another mucous cast, and entangled in the meshes formed by its branches, I was fortunate enough to discover several free mature embryos (Figs. 10, 16). They measure $\frac{1}{200}$ to $\frac{1}{160}$ of an inch long, and the $\frac{1}{350}$ inch broad, being a little larger than the egg-case. The general shape is elliptical, but the sides are rarely symmetrically curved; the posterior extremity is a little contracted and rounded; the anterior terminates in a papillary sucker-like prolongation, possessing a central depression leading to a canal into which two or three smaller canals appear to converge. These canals are lost below in the spherules which are contained within the interior, or in a pyriform mass of them, which is sometimes observed to occupy the anterior part of the embryo. Besides this there is in some of the embryos indications of a

differentiation of the interior, which is composed of granules and spherules of various sizes, partially distributed. The whole external surface, which is formed of a distinct thickish integument, is clothed with delicate, exceedingly close-set cilia; they are best developed at a little distance from the sucker-like anterior extremity, where the surface is minutely punctated by the origin of the cilia. Fig. 15 shows the escape of a mature embryo from the egg-case.

Seeking to get some knowledge of the animal in the more advanced stages of its existence, I have met with a small portion of ciliated integument, which, as it may belong to the parasite, I will briefly describe. The minute fragment is delineated in Fig. 11. From its rounded form I think the individual to which it belonged was more spherical than cylindrical. The cilia or hairs are simple, homogeneous, and elongato-conical; they average the $\frac{1}{300}$ of an inch long, and are distributed at intervals of the $\frac{1}{800}$ of an inch. The integument itself is delicate and homogeneous, or only very faintly granular. The relative sizes of this bit of integument and the mature embryo may be judged of by comparing Figs. 10 and 11, bearing in mind that Fig. 10 is magnified thrice as much as Fig. 11.

So far for facts. I have now to inquire to what particular animal the parts above described belong. They have no relationship whatever to the cestoid entozoa; the form and structure of the egg and hooked embryo in this class are quite different. The anatomical characters of the ovum, its development into a ciliated embryo, the form of that embryo (which is that of an adult Distomum) and the probability, suggested by the piece of ciliated integument—which, in the absence of other means of diagnosis, I may fairly, I think, use—that the adult parasite possesses a ciliated integument, all point to the trematode worms. The ciliated embryo closely resembles a certain species of Monostomum, and it possesses also several characters in common with the embryos of such of the Distomata as have been described. Monostomum does not, as far as is known, inhabit the human body; I shall therefore limit

myself to a comparison with the genus Distomum. Six species of this genus inhabit man, viz., *D. hepaticum, crassum, lanceolatum, heterophyes, hæmatobium*, and *ophthalmobium*. Too little is known of the last-mentioned species to allow of any comparison. The ovum and ciliated embryo above described are quite distinct from the corresponding parts both of *D. hepaticum* and *D. lanceolatum*, and probably also from those, which have not yet been observed, of *D. crassum*. The eggs of the former two species are wanting in the anterior spine; the ciliated embryo of *D. hepaticum* is conical, and the papilla which terminates its anterior extremity is depressed. The ciliated embryo of *D. lanceolatum* is oblately spherical, and ciliated only about its anterior extremity.[1] We may therefore confine our attention to the two remaining species. *D. heterophyes* is very minute; its length does not exceed three fourths of a line. The skin is beset with small spines, directed backwards, and they are particularly numerous in front. The intestinal canal is composed of a short, narrow, membranous œsophagus, terminating in an oblong muscular pharynx, which is continuous with a narrow cibarian canal, dividing, as usual, in front of the ventral sucker into two lateral intestinal tubes.[2] This rare parasite was discovered by Dr. Bilharz in Egypt. He found them in two cases only, inhabiting the small intestine in great numbers. But it is to *D. hæmatobium* (*Bilharzia hæmatobia, Gynæcophorus hæmatobius*) that the organisms in question have the greatest resemblance. Bilharz,[3] and Griesinger,[4] followed by Derseble,[5] Kückenmeister,[6] and Leuchart[7] have described this parasite. It is a white, soft-skinned, elongated entozoon, resembling a nematoid worm. The anterior part of the body is smooth, the posterior part

[1] See figs. in Leuchart's 'Die Menschlichen Parasiten.'
[2] Bilharz and Siebold, 'Zeitschrift für Wissenschaft Zool.,' iv.
[3] Ibid., § 59, 72, and 454.
[4] 'Archives für physiol. Heilkunde,' 1854, Jahrg. xiii, § 561.
[5] 'Wiener medic. Wochenschrift,' 1856, N. 4.
[6] 'Manual of Parasites,' vol. i.
[7] Op. cit., p. 491.

is beset with short hairs; its length is three lines; it has an oval and a ventral sucker, and a gynæcophoric canal. The ova are strongly pointed at one end, the egg-shell dehisces longitudinally. The ciliated embryo measures 0·37 millimètre, $= \frac{1}{67}$ of an English inch, in length, and the 0·11 millimètre, $= \frac{1}{227}$ of an inch, in breadth. It has a cylindrical form, and is rather thicker anteriorly than posteriorly. It is covered all over with tolerably long cilia, and is furnished at the anterior end with a proboscidiform projection, presenting a sucker-like impression from which run two slender lines, terminating in a pair of closely approximated sacs. The presence of the gynæcophoric canal is a sufficient reason for separating this animal from the genus Distomum; I shall therefore follow Dr. Cobbold, and call it, after its discoverer, *Bilharzia hæmatobia*.

The resemblance of the parts above described with the corresponding parts of *Bilharzia hæmatobia* will now be readily inferred, and they will be found to be very close indeed. The two parasites further agree in other important particulars.

B. hæmatobia is the cause of the endemic hæmaturia and gravel complaint, or lithiasis, of Egypt, and the parasite is so abundant in this country that Griesinger found it in 117 out of 363 human post-mortem examinations. It chiefly inhabits the small veins of the mucous membrane and substance of the urinary apparatus.

After careful comparison, however, of the ciliated embryo, which I have described, with Griesinger's figures of *B. hæmatobia*, there remain sufficient differences to induce me for the present to refer the former to some other species; and from the locality in which I have discovered the parasite, I will call it *Bilharzia Capensis*.

With respect to the distribution of *Bilharzia*, it is worthy of remark that Cairo and Uitenhage of the same continent are equidistant, north and south, from the equator, and within 15° of the same longitude. I ought, however, to mention that my patient, who is a very observant man, believes he derived the urinary disease from the water in use at Nagasaki; but, according to this supposition, the animal

must have arrived at mature development, and have manifested its presence in the urinary organs, within four months. I am rather inclined to believe that he received the animal at the Cape.

It were unsafe to conclude from this single instance of the association of the parasite above described with hæmaturia, that it is the constant cause of the hæmaturia of the Cape, but from what we know of endemic hæmaturia the probabilities are greatly in favour of this conclusion.

Since writing the above I have received, through my friend, Mr. E. Atherstone, an introduction to Mr. George Dunsterville, F.R.C.S., surgeon to the infirmary at Port Elizabeth. This is a singular piece of good fortune, for Mr. Dunsterville has been in practice in that town for twenty-seven years, and is therefore familiar with the disease.

Mr. Dunsterville has most courteously furnished me with the following particulars:

1. Hæmaturia is common in Uitenhage and in Port Elizabeth. It has been long prevalent in the former town. The female sex and the native population, as far as Mr. Dunsterville is aware, are free from it. It affects boys at the age of three or four years, and is most prevalent between this age and sixteen. Two, out of every three schoolboys, are affected with it. It gradually disappears about the age of puberty.

2. The symptoms are a smarting or burning sensation in passing urine, and at the end of micturition a flow of about a teaspoonful of pure blood, or a discharge of ropy mucus tinged with blood. The shirts of boys affected with the disease are often stained as if they had the menstrual discharge of the other sex. There is no pain in the urinary organs. The urine is never stained with blood. Gravel is a common complaint, stone is not uncommon.

3. Of the cause of the disease nothing was known. It was so common, occasioned so little inconvenience, and fairly exhausted without avail every plan of treatment; while, at the same time, experience showed that it generally subsided after the age of puberty, and apparently entailed

no subsequent complications, that the medical practitioners, in the absence of proper means and sufficient leisure for making minute investigations, had long ceased to pay particular attention to the disease.

4. The drinking-water in Port Elizabeth is partly derived from the superficial drainage of twenty miles of plain by means of wells ten or twelve feet deep, and partly from rain water conveyed by zinc or iron roof-gutters into tanks of various material. The well water is brackish.

Almost the whole of the vegetables, including salads, used in Port Elizabeth are obtained from Uitenhage. Periwinkles are very abundant in Algoa Bay.

The natives and colonists are affected with Tænia and *Ascaris lumbricoides*, both of which parasites are very common. Some time ago the latter appeared in great numbers, and infested both old and young. Some patients evacuated during this epidemic as many as forty worms.

A year ago a number of horses died from an epidemic of "bot worms," which attacked the stomach.

Mr. Dunsterville kindly introduced me to his two sons, young gentlemen of the ages of seventeen and twenty respectively. They had, in common with the other young men of Port Elizabeth, suffered from hæmaturia, but it had disappeared of late, and they considered themselves to be free from the disorder. The elder (Mr. G. Dunsterville, jun.), however, had been greatly troubled during the last six months with gravel, and had passed during this time four or five renal calculi. He described his urine as being like chalk and water. On examining it, I was able to demonstrate to Mr. Dunsterville the presence of several ova of Bilharzia. One is delineated in Fig. 13. The secretion was highly acid, and loaded with a fine crystalline deposit of oxalate of lime and uric acid.

The urine of the younger gentleman (Mr. C. Dunsterville) was full coloured and clear, but usually contained a little deposit of oxalate of lime in distinct octahedra. In the first sample which I examined I could detect with a pocket lens a few floating ova, which under the microscope presented all

the characters of those above described. Besides these I found a long sinuous tube (Fig. 14), dilated at one end into a pyriform enlargement (*a*), about $\frac{1}{60}$ of an inch long and $\frac{1}{120}$ of an inch wide; another similar dilatation of half the size (*b*) occurred about the middle of the length of the tube. At the extremity of the first dilatation or sac, and apparently attached to it, was a third pyriform sac (*c*), corresponding in size to the second. From this, two secondary tubes, smaller than the primary one, parted, the one (*f*) being continuous with it below; the other (*g*), which was indistinctly connected with it, passed away for a distance, and, after apparently joining the first, terminated in a free extremity. The main tube was considerably contracted at a distance from the second dilatation, and around this part, and apparently connected with it, were a number of excessively fine linear processes (probably tubes), some of which were very long (*d*); below this the tube dilated into a wider terminal portion (*e*). The length of the extended tube was about one sixth of an inch. The whole organ was structureless and of the most excessive delicacy; it contained only a few bright granules. It is probably the intestinal canal of the parasite.

I have repeatedly examined (during December) the urinary secretion of both these gentlemen, and have never failed to detect ova; generally they were numerous, and some hundreds must have been passed most days. When the crystalline deposits were abundant, the ova were usually encrusted with them.

Mr. G. Dunsterville, jun., has suffered much of late from the passage of small renal calculi, and has brought me several for examination. They are of a dirty white colour and crystalline structure, and are chiefly composed of oxalate of lime. On crushing them and treating them successively with nitric acid and solution of potash, I was enabled to detect the presence of considerable numbers of ova, which had, no doubt, afforded a nucleus for the crystalline deposit. In this case the symptoms indicate that the parasite inhabits the kidney.

It is remarkable that the hæmaturia should thus disappear while its original cause still remains. It can only be accounted for by supposing that the animals form non-vascular cysts around them, which retain communication with the natural passages.

The parasitic origin of the hæmaturia of the Cape being thus satisfactorily, I believe, determined, I would say a few words on—

Treatment.—Mr. Dunsterville tells me that every remedy which exists for hæmaturia has been tried to the full without effect. But it must be borne in mind that the medicines were administered empirically, and with a view to check a symptom, and not to remove the cause, which, being now known, we may at least hope to prevent.

In the treatment of the disease our efforts must be directed—(1) to kill or expel the adult sexual parasites; and, should our efforts to do so be unavailing, (2) to secure the regular expulsion of the ova, which, so long as they remain in the body, may at any time become the nuclei of urinary calculi. It has been already stated that gravel is very prevalent in the same localities as the hæmaturia; and, as I have shown in one case, there can be very little doubt that it is caused in the majority of the inhabitants of these parts, who are thus afflicted, by the parasite in question, the presence of which induces a highly saline condition of the urine, and the formation of crystalline deposits around the ova.

The success which attends the treatment of intestinal parasites leads one to hope that some specific may be found against Bilharzia, which, long after the disappearance of the more obvious evidence of its presence—hæmaturia—is liable to prove a very dangerous associate. But the case of the urinary parasite is very different from that of the intestinal. The Bilharzia is not simply attached to the free surface of the mucous membrane, but lies within the orifices of the smaller veins; and the substances which pass through the kidney on their way out of the system are very few compared with those which find a more direct passage through

the intestinal canal. It appears, therefore, that in order to fulfil the first object, we must either sufficiently saturate the blood with a remedy poisonous to the parasite, or lead through the kidneys some substance which may prove hurtful to it. The aromatic diuretics (essential oils), such as turpentine, copaiba, cubebs, bucco, give some promise. Santonine, being an anthelmintic which becomes diffused in the blood, is worthy of a persevering trial. I have found that a draught, composed of ℥xv each of oil of turpentine and male fern, and ℥v of chloroform, in ℥ij of tragacanth mixture, given every morning, brought away great numbers of the ova. The saline condition of the urine is much diminished, and the renal irritation and pain due to the presence of crystalline concretions are much relieved by the administration of bicarbonate of potash in copious draughts of water. The alkali dissolves the uric acid, which I believe to be the cementing medium of the oxalic deposits, and thus the disintegration of the calculi is facilitated, and their formation prevented.

Here I must conclude. I have sought in vain for more knowledge of the complete sexual animal, but with this I feel sure that we shall soon become acquainted. I have made known the chief facts above recorded to Mr. Dunsterville, who has already communicated them to a medical friend at the Cape; and, as Mr. Dunsterville will himself shortly return thither, we shall not long, I feel convinced, remain ignorant of the whole of the history of that animal, the early stage of whose existence I have had the pleasure of bringing before you. I have been minute in my description of the forms, and particular in my illustration of them, because during the life of the patient they must needs constitute the chief, if not the only, evidence of the particular disease to which they give rise.

Appendix.

On February 26th, 1864, my friend Mr. Dunsterville wrote me as follows:—"You will be sorry to hear that my younger son passed a small calculus a day or two ago, similar to those passed by his brother—confirming your anticipations." This is an interesting fact, since it shows how soon after the disappearance of the hæmaturia another disease, apparently unassociated with it, but really dependent upon the same cause, may manifest itself. The young gentleman alluded to had not been troubled with hæmaturia for more than a year, and believed himself to be perfectly free from any urinary or renal disorder. His urine, as I have previously recorded, invariably contained ova of the parasite, and usually a slight deposit of oxalates, but not sufficient to excite his attention.

With regard to the distribution of the disease, I have since ascertained the following additional facts—viz., (1) that the disease prevails in Natal; (2) that in the Cape Colony it appears to be limited to Port Elizabeth and Uitenhage.

Dr. J. W. Johnston, resident for four years in Natal as assistant-surgeon to the 85th Regiment, has made the following communication to my friend Dr. E. Symes Thompson:—"Hæmaturia prevails to some extent among the children of the civil community of Natal, and attacks both sexes, but boys more frequently than girls. I could not determine satisfactorily the source of the hæmorrhage; sometimes the blood would be uniformly diffused in the urine; occasionally in the same patient, after the bladder was emptied, about a teaspoonful of blood would be passed, sometimes with, generally without, pain; at other times

coagulated blood would be passed, having the size and shape of the ureter. The hæmorrhage appeared to be passive, the result of simple congestion. There was neither lumbar pain, pyrexia, irritability of the bladder, turbid urine, or other indications of nephritis or vesical disease."

Adults are also liable to become affected. Mr. Joseph Henderson, whose acquaintance I have lately had the pleasure of making, and who has resided for many years in Natal, informs me that a family of colonists, consisting of three adult brothers, having settled between Port Natal and Pietermaritzburg, on the banks of the Sterk Spruit,[1] a tributary of the Umlazi, became affected with hæmaturia, and were obliged, after a residence of two years, to leave the country on this account. They believed the water of this stream to be the cause of the disease. Mr. Henderson writes me the following, which has an obvious bearing upon the identity of the disease prevalent in Mauritius:—"A friend of mine from the colony, who is now with me, says hæmaturia is a very common complaint in Natal, and names several people who were subject to it; he also says it is common in Mauritius."

As to the prevalence of the disease in the Cape Colony, Mr. George Saunders, staff-surgeon, has most obligingly furnished me with the result of his own observations, and also those of some of his friends. He writes—"While at Port Elizabeth I was greatly struck with the number of cases of hæmaturia in young boys, and on inquiry was informed that the disease was very common at Uitenhage, which is about ten miles distant from Port Elizabeth. I never met with hæmaturia at Graham's Town, which is ninety-five miles from Port Elizabeth, nor at Fort Beaufort or Alice, fifty miles up the country."

Mr. Robert Speedy, of the 45th Regiment, writes—

[1] The Sterk Spruit is a small stream about thirty miles from D'Urban, on the old road between D'Urban and Pietermaritzburg.

"Hæmaturia was not prevalent either at East London or King William's Town. I know that at Uitenhage many cases occurred. I met two gentlemen from the Cape who were labouring under the affection in an aggravated form. They stated that they had derived little benefit from treatment."

After reading the cases narrated by Chapotin, Salesse, and Rayer (op. cit., p. 56), I feel convinced that the disease prevalent in Mauritius is in all respects identical with that existent in parts of the neighbouring continent. The following extracts carry conviction with them, while they serve at the same time to indicate the theories which up to the present time have been held respecting the cause of endemic hæmaturia:—"In the Isle-of-France children of both sexes are affected from the tenderest age with hæmaturia, which announces the weakness of the mucous membrane of the kidneys. With some the disease is slight and continual; with others it returns at intervals with different degrees of force. It generally disappears at the age of puberty, but it is often prolonged beyond that time. The hæmaturia is frequently replaced by attacks of nephritic colic, which appears to depend as much upon a too abundant mucous secretion as upon engorgement of the blood-vessels of that part from the presence of renal calculi" (Chapotin). "Three fourths of the children of the Isle-of-France are attacked with hæmaturia. Masturbation and spiced dishes are the determining causes of it. The malady has also been attributed to a bad quality of the water employed for drink" (Salesse).

Prophylaxis.—As the prevention of the disease is a matter of the gravest importance to the communities amongst which the parasite is found, a few suggestions on this subject, for the consideration of those who are more immediately concerned, will not be out of place. According to the observations of Professor Siebold on the trematode worms, it may safely be assumed that between the ciliated embryo above described and the adult sexual animal there are probably two

other distinct forms, which serve to complete the chain of metamorphoses connecting these two extremes of development. What these forms are, and what their transmigrations, are the questions which require careful elucidation. The ciliated embryo is adapted for an aquatic existence. Swimming freely about, these minute organisms probably come in contact with certain mollusca, and become developed within them into what have been called *cercaria-sacs*, but which may perhaps be more significantly termed *free pseudovaria*. In the interior of these, we may still further assume, little caudate worms, or *cercariæ*, are budded off, and, leaving the pseudovarium, bore their way out of the body of the animal, to again become free inhabitants of the water, from whence they may be directly transferred to the alimentary canal of man, or indirectly by means of some other animal used by him as food. Once admitted to the body of a suitable vertebrate animal the cercaria loses its tail, and becomes developed into the perfect sexual form. Fresh-water mollusca and fish are probably the victims selected by the parasite during its development through these intermediate stages. How far these assumptions are correct is the subject matter of further investigation. Whatever may be the truth, the following precautions are positively indicated:—1. The water should be conveyed from its source to its destination in covered channels, so that the ova contained in the urinary, and probably the fæcal, products of those infested with the parasite may be prevented mixing with it. It is obviously desirable to ascertain whether any of the domestic animals are the means of thus disseminating the parasite. 2. Drinking-water should be filtered. 3. Salads which may entangle small mollusca containing parasites, and uncooked molluscs and fish (as smoked fish), should be carefully avoided.

Fig: 10.

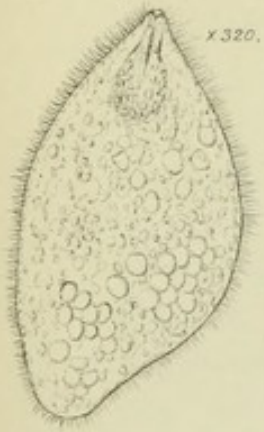


Fig: 11.

Fig: 12.

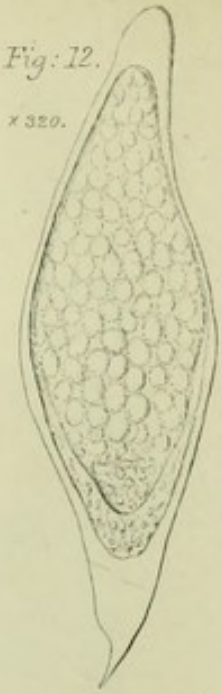
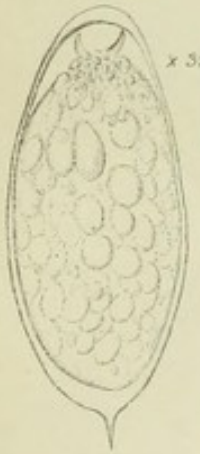


Fig: 13.



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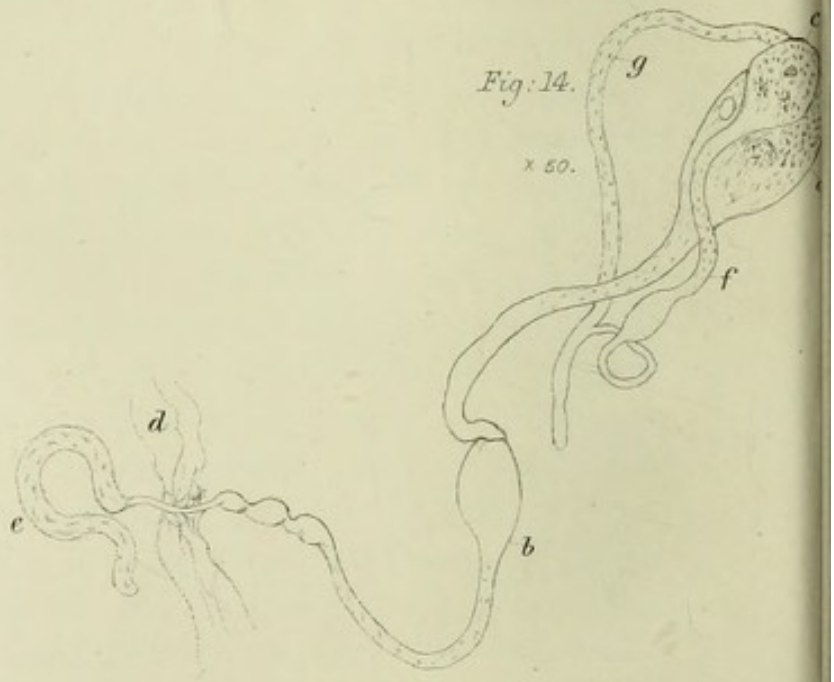


Fig: 15.

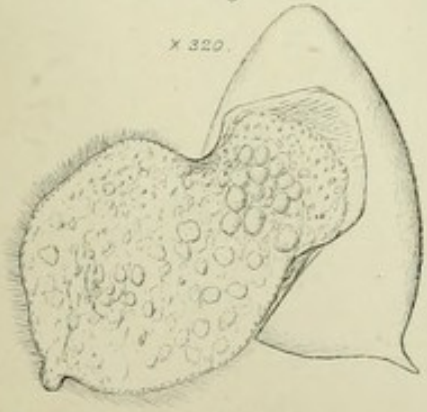
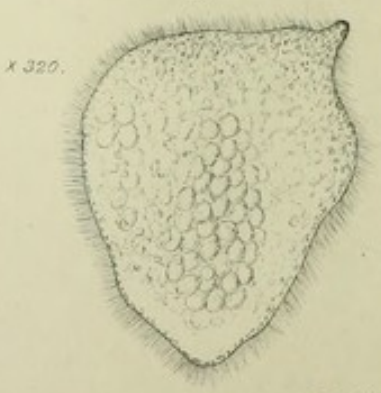


Fig: 16.



Dr John Harley, del. ad nat. G.H.F.

W. West, imp

Fig: 1.

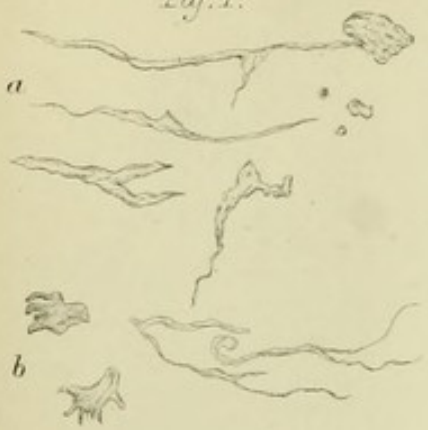


Fig: 2.

× 50.

Fig: 4.

× 100.

Fig: 3.

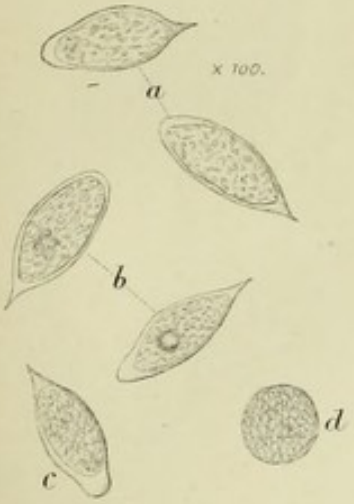


Fig: 5.

× 200.

Fig: 6.

× 320.

Fig. 7.

× 200.

Fig: 8.

× 320.

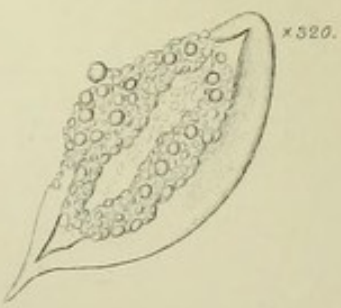
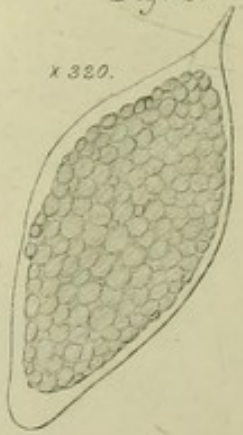


Fig: 9.

× 320.



EXPLANATION OF PLATES II AND II*a*.

Fig 1.—*a*. Filaments and lumps of mucus, containing ova, derived from one specimen of urine. Natural size.
b. Ditto ditto from another specimen.

„ 2.—A portion of *b*, fig. 1, magnified 50 diameters.

„ 3.—Impregnated ova—*a*, *a*, *c*, as they appear in the fresh urine; *b*, *b*, after maceration in carbolic-acid water or glycerine; *d*, spherical mass, probably the escaped embryo mass, which has assumed a spherical figure. × 100.

„ 4.—Embryo mass, escaped from the longitudinally dehisced egg-case. × 100.

„ 5.—Ovum, imbedded in mucus. × 200.

„ 6.—Ovum, in a more advanced stage. × 320.

„ 7.—Ovum, × 200, common appearance, showing spherules of the embryo mass.

„ 8, 9.—Ova, after maceration in water acidulated with hydrochloric acid. Fig. 8 shows longitudinal dehiscence of the egg-case, and liberation of fatty spherules and granules. × 320.

„ 10.—Ciliated embryo. × 320.

„ 11.—Ciliated integument, probably belonging to an adult Bilharzia. × 100.

„ 12.—Elongated and waved form of ovum. × 320.

„ 13.—Another form of ovum, with abrupt spine. × 320.

„ 14.—Compound sacculated tube, probably the intestinal canal of the parasite. × 50.

„ 15.—Ciliated embryo escaping from the egg-case. × 320.

„ 16.—Another form of ciliated embryo. × 320.

Ref. wird in Jahresbericht über die Leistungen in der Medicin
1866. I. S. 285.

A SECOND COMMUNICATION

ON THE

ENDEMIC HÆMATURIA OF THE CAPE OF GOOD HOPE AND NATAL.

BY

JOHN HARLEY, M.D. Lond., F.R.C.P., &c.

[*From Volume LII of the 'Medico-Chirurgical Transactions,' published by the Royal Medical and Chirurgical Society of London.*]

LONDON:

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J. E. ADLARD, BARTHOLOMEW CLOSE.

1869.

A SECOND COMMUNICATION

ON THE

ENDEMIC HÆMATURIA OF THE CAPE OF GOOD HOPE AND NATAL.

BY

JOHN HARLEY, M.D. Lond., F.R.C.P., &c.

Received June 8th.—Read June 22nd, 1869.

In the 47th volume of the 'Medico-Chirurgical Transactions,' I called attention to the existence of an endemic form of hæmaturia in certain parts of the Cape of Good Hope and Natal; proved that the disease was due to a species of Bilharzia; and attributed the well-known hæmaturia of Mauritius to the same cause.

More than five years have elapsed since these observations were made known, and yet, so far as I am aware, no other observer has repeated them; I therefore feel it necessary that I should lay before the Society, and through it, the profession generally, such further information as I have been able to obtain since the date of my former communication.

Since returning to Port Elizabeth, my friend Mr. Dunsterville, F.R.C.S., has furnished me with the following illustrations of the disease.

1. Two small renal calculi from a young man aged nineteen. "He has had the characteristic hæmaturia for years, and of late has suffered much from occasional paroxysms of pain due to the passage of renal concretions."

The progress of the disease and its attendant symptoms in this patient are identical with those of the case next referred to.

"2. Mr. G. D—,[1] still (June, 1866) continues to pass renal calculi occasionally, accompanied as usual by severe lumbar pain and suffering. I send, enclosed, the last voided—a very small one."

I crushed up this minute crystalline body after it had lain in a dry state for three years, and after treating it successively with solution of potash and nitric acid discovered by the aid of a half inch object-glass one entire egg of Bilharzia, and several unmistakable fragments of others.

3. At the same date (June, 1866) Mr. Dunsterville states: "I really think we have not nearly so much of the hæmaturia as formerly. I have not seen a case for a very long period, and certainly none has offered which gave me a chance of sending you any of the deposits or post-mortem scrapings of mucous membrane which you so much desired."

4. Two years previously Mr. Dunsterville sent me by his friend and colleague Dr. Rubidge two samples of urine secreted respectively by two brothers, William and Philip Jones. They had the usual symptoms of the disease. The urine of the first-named patient was mouldy, strongly ammoniacal, and had deposited much phosphate. It nevertheless contained numerous well-preserved eggs of Bilharzia. The secretion from the other patient was fœtid and had deposited much uric acid. It also contained well-preserved eggs of the parasite, and in the few drops examined there were four adult cheese mites (*Acarus domesticus*), and two advanced eggs of the acarian, distinguished from those of Bilharzia by their uniformly rounded extremities. I mention this fact because, having only twice before observed acarus in the urine, it chanced each time to be that of a patient suffering from the endemic hæmaturia.

Dr. Rubidge, of Port Elizabeth, wrote me the following in 1866:

[1] 'Medico-Chir. Trans.,' vol. xlvii, p. 65.

"In compliance with your request that I would furnish you with all the information I can obtain on the subject of the endemic hæmaturia of this and the neighbouring town of Uitenhage, I send you the following notes: It is almost strictly confined to these places and to Fort Beaufort."[1]

"It occurs in young Europeans or persons of European descent. The natives,[2] as far as I have inquired, are not subject to it, nor I think the Malays or negroes imported in former times as slaves."

"Pretty extensive inquiries lead me to believe that bathing in rivers has something to do with the production of the disease. I have never met with a case in boys who did not frequently bathe in the Zwarlkojss or Booker's river. On the other hand, those few boys in the families of my patients who are free from the disease, bathe in the sea only. My impression is that the parasite gains entrance into the skin while the individual is bathing in the river, and I may mention that the lad W. Jones, whose urine I took home to you (see above, 4), described a sort of urticarious eruption attended with great irritation, as a frequent result of bathing in the Booker's River.[3]

"The hæmaturia never, I believe, occurs in children under five or six years of age. Females are rarely affected, if at all. I have not myself observed a single well-marked case in this sex."

In a letter to my friend Mr. Henry Lee, Dr. S. Spranger, referring to my observations on the hæmaturia of the Cape, relates two cases. The one is too doubtful, I think, to advance as an instance of the disease; the other is as follows:

"Mr. S—, of Alice, consulted me about two years ago,

[1] Mr. George Saunders has not observed it here. See 'Med.-Chir. Trans.,' vol. xlvii, p. 70.

[2] On this point see corroborative statement further on—p. 386.

[3] I carefully examined a number of fresh-water mussels (*Unio Kaffre*) from this river, and sent to me by my friend Mr. Dunsterville. I failed to detect any trace of Bilharzia, but the paleal membrane of every individual was thickened and speckled by vast numbers of the acarian *Hypopus* in every stage of development.

suffering from hæmaturia. The symptoms were those described by Dr. Harley, only of a very aggravated nature. They were of long standing. The patient was a Scotchman, aged seventy-six, and had been hale and hearty. He was more or less under my care for three months. He died worn out by the various concomitants of his disorder. As I was in a distant part of the colony at the time of his death, no post-mortem was made. I would remark that these cases are not confined to Uitenhage and Port Elizabeth, I have found them in Alice[1] and in British Kaffraria. *Army surgeons do not commonly see many of those living on the soil,* and their troops do not remain long enough to contract the disease.[2] The water over almost the whole of the eastern part of the colony is *brackish,* but the disorder is more probably contracted from Vleys or ponds by the wayside, than from the running streams."

Thus much for the disease in the Cape Colony, I now turn to Natal.

In my former communication, I concluded from the statements of Dr. W. Johnstone, and Mr. Joseph Henderson ('Medico-Chirurgical Transactions,' vol. xlvii, pp. 67 and 70), that the parasitic disease was prevalent in Natal. I am now enabled to advance proofs of the truth of this conclusion.

Case of endemic hæmaturia in a colonist of Natal.—The patient arrived in England in the spring of the present year and continues at the present time under my care. The following is his history. He is a healthy and remarkably active man, aged thirty-seven, is married and has a healthy young family. He has resided near Verulam, on the banks of the Umhlazren, a tributary of the Umhloti, since the year 1860, and first noticed hæmaturia January 1868. The symptoms are the passage of small shreddy flakes or strings, either opaque and colourless, or like minute clots of blood, and occasionally at the end of micturition a

[1] Contradictory evidence, see 'Med.-Chir. Trans.,' vol. xlvii, p. 70.

[2] It appears that a residence of six months is sufficient. See a subsequent page—7.

teaspoonful or two of bloody urine. There is a slight tickling sensation at times in the hinder part of the urethra never amounting to pain, but sufficient to cause inconvenience, and, at times, annoyance. Occasionally there is a feeling of slight oppression in the hypogastric region accompanied by lassitude. The general health is very good.

The first specimen of urine (a tablespoonful) which he brought to me was turbid and of a blood colour. It deposited a layer of blood-stained organic matter in which were entangled many of the characteristic ova of Bilharzia Capensis. The next sample was of natural colour, deposited a flocculent, specky mucus, together with one or two larger and more consistent flakes of mucus, of a dirty white colour or more or less completely stained with blood. The largest did not much exceed a hemp seed in bulk, and contained imbedded within it between two and three hundred eggs of the parasite.

I have examined the urine voided daily for months, and on each occasion found numbers of the ova floating freely in the urine, and also, when it is present, imbedded in a dense opaque mucus, which seems to be their appropriate nidus. The fertility of the parasite is wonderful. When I first saw my patient he was voiding hundreds of eggs daily, and sometimes they could be numbered by thousands.

The urine itself is normal in quantity, and—apart from the products of the parasite, and occasionally a little blood and albumen—in composition also. There is no tendency to ordinary cystitis or to ammoniacal alkalinity of the urine. Indeed it is constantly acid and frequently deposits lithic acid on standing. The sp. gr. ranges from 1015 to 1025, the colour is rather pale. The albumen of course varies with the quantity of blood contained in the secretion. At most it does not exceed in bulk one fifth that of the urine, and when the secretion is as colourless as whey, only a very faint opalescence is produced by the means requisite for the precipitation of the albumen.

As to the parasite itself, I have nothing to add. The

figures which accompany my first papers furnish a complete delineation of the parasitic products in the present case. The mucus in which the eggs are for the most part imbedded, is derived, I believe, from the mucous crypts in which the animal takes up its abode, the growth of the mucous corpuscles being due to the irritation caused by the body of the parasite and its eggs, just as occurs in the vegetable kingdom in the development of a ball or gall on the oak around the ova of *cynips*. As soon as the solid mucus fills the crypt it is forced out by the continued production of eggs, and, being thus roughly moulded, appears in the urine in the form of little pellets or strings. Some softer or more fluid masses become disintegrated and form the usual flocculent mucous deposit.

Treatment.—The parasites being thus safely lodged in the mucous crypts, the mouths of which are closed by their deposits, it would be of course useless to attempt an attack on the parasite by local means. Even if the body of the parasite lay bare upon the surface of the mucous membrane the injection of styptics into the bladder would probably do more injury to the host than to the parasite. In my opinion, topical treatment is therefore out of the question, and we are reduced to the use of such general remedies as passing unaltered through the kidneys may exercise an injurious effect on the parasite. I have shown that the active principles of belladonna and hyoscyamus are wholly removed in an unchanged condition in the urine;[1] and I am hopeful that these substances thus brought in contact with the parasite may at least restrict its development, and by constantly dwarfing its growth, ultimately destroy it. Guided by these considerations I prescribed the following for my patient: ℞ Extracti hyoscyami gr. v, Oxydi argenti gr. $\frac{1}{4}$; fiat pilula, omni nocte sumenda. And with the view of annoying the parasite as thoroughly as possible I gave a morning dose composed of the following: ℞ Olei Cubebæ ♏x—♏xv, Spiritus vini rectificati ʒij, Infusi Absinthii ad ʒiss; fiat haustus.

[1] 'The Old Vegetable Neurotics,' pp. 213—336.

Up to the present time I have reason to be satisfied with this treatment. Since it was commenced a little free blood has been only twice voided; the albumen has disappeared; free mucus, which previously formed a large dense cloud, is now rarely present, and the oviparous function of the parasite is decidedly less active.

Further information respecting the prevalence of the disease in Natal.—My patient tells me that he is acquainted with five male adult Europeans resident in his district who are affected by the disease. Their symptoms correspond exactly with his own, but some have lumbar and hypogastric pain superadded. The parasite appears to be limited, as in the Cape, to certain localities near the coast. Of the two known habitats one is the Sterk Spruit, a tributary of the Umlazi, situated about seventeen miles from the sea, in County Durban;[1] and the other in Victoria, the Umhlazren, a tributary of the Umhloti, distant about five miles from the coast. These two stations are about twenty-five miles apart. How far the contamination of the two principal rivers above mentioned extends inland remains to be determined. It appears that the elevated regions of the interior[2] are free from the parasite.

One fine young man, aged twenty-eight, is a great sufferer. He had resided the greater part of his life up the country, and had only recently come down to the coast, and since that time he has contracted the disease.

My patient employs a large number of men, chiefly coolies imported from Madras and Bombay, and some Kaffirs. The coolies become affected with hæmaturia after a residence of five or six months in the colony. They complain at intervals of lassitude and inability to work, and it is not an uncommon event for three or four of the men together to prefer their complaints to my truly sympathising patient,

[1] 'Medico-Chirurg. Trans.,' vol. xlvii, p. 70.

[2] Pietermaritzburgh and Greytown, situated about fifty miles from the coast, have the altitudes of 2000 feet and 3580 feet respectively.

bearing on castor-oil leaves the little bloody strings voided in the urine, as evidence of their malady.

This gentleman further states that the Kaffirs are wholly free from the disease, and this corroborates the previously expressed opinions of my friends Dr. Dunsterville and Dr. Rubidge. The last-named gentleman assigns bathing as the means of receiving the parasite, and my present patient tells me that he bathes every evening in the waters of the Umhlazren, which flow through his private bathing house. The workmen also bathe frequently in this river.

It is certainly more reasonable to suppose that the parasite gains access to the bladder and kidney by the urethra than to assume that it reaches the urinary organs—and these only, as appears to be the case at first—through the general circulation. But in seeking to know the mode of invasion we must be prepared to turn our investigations readily in any direction. The Kaffirs, it appears, are free from the Bilharzia, while they are infested with tape-worm; the colonists and coolies, on the contrary, are very liable to the invasion of Bilharzia. With regard to the habits of these two races, Mr. Le Mesurier communicates the following, which is inconsistent with the notion that the parasite gains access to the body during the process of bathing. "The Kaffirs are very attentive to personal cleanliness; they bathe and wash every day, and in the hot weather three or four times a day. The coolies, as a rule, are not cleanly in their persons, and they bathe much less frequently."

On mentioning salads to my patient, as a possible means of taking the parasite, he said, "I do eat salads, and all green food very freely, and your question reminds me of a curious and perhaps important fact. On the estate adjoining ours there is an abundant supply of water-cress, and one of the two Europeans living on the estate has been troubled for a long time with the hæmaturia. They both make water-cress a standing dish at their table; I obtained some plants from them and formed a bed, and it was after occasionally eating the cress for breakfast that I discovered I was affected with the disease."

One question I hope to be able to determine before long, viz. whether the parasite is able to attain mature development in the animal body, the egg being the starting-point.

It is to be hoped that those of our medical brethren who have the means of tracing the development of the parasite in its native habitat will lose no opportunity of doing so. The disease is altogether preventible, and he who may be fortunate in discovering how and where precisely the enemy is to be avoided will merit the gratitude of his countrymen.

Postscript.—At page 2 I have called attention to the occasional presence of *Acari* in the urine. It is remarkable that I have repeatedly observed the same fact with regard to the secretion of my Natal patient.

A THIRD COMMUNICATION

ON THE

ENDEMIC HÆMATURIA OF THE SOUTH-EASTERN COAST OF AFRICA.

WITH REMARKS ON THE

TOPICAL MEDICATION OF THE BLADDER.

BY

JOHN HARLEY, M.D. Lond., F.R.C.P.,

PHYSICIAN TO THE LONDON FEVER HOSPITAL, ASSISTANT-PHYSICIAN TO ST. THOMAS'S HOSPITAL, ETC.

[*From Volume LIV of the 'Medico-Chirurgical Transactions,' published by the Royal Medical and Chirurgical Society of London.*]

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J. E. ADLARD, BARTHOLOMEW CLOSE.

1871.

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PHYSICIAN TO THE LONDON FEVER HOSPITAL, ASSISTANT PHYSICIAN TO ST. THOMAS'S HOSPITAL, ETC.

Received June 28th.—Read November 22nd, 1870.

In my previous papers I have described the general symptoms of this parasitic disease, and have given all the information respecting its cause which I was able to obtain up to the time of their publication.

Since I presented my last communication to the Society I have had almost daily opportunity throughout nearly a year of watching the progress of the disease, and am now enabled to give more precise information respecting certain features of this interesting malady.

My observations have reference, *first*, to the prostatic form of the disease and its treatment; and *secondly*, to the structure and development of the parasite.

1. *The prostatic form of parasitic hæmaturia.*—In the patient upon whom the following observations were made,

the disease was confined to the prostatic portion of the urethra, as was indicated, negatively, by the absence of vesical or renal disturbance; and positively by the following symptoms: an intermittent discharge, by the urethra, of venous blood never exceeding a teaspoonful, and always mixed with urine, recurring after variable intervals of from two to fourteen days, and continuing for several days in succession. Excepting a cloudiness of the urine from the presence of free mucus, which on settling formed a russet or drab-coloured fluffy deposit, the morbid appearances were confined to the last tablespoonful of urine. With this was discharged a variable amount of blood and the branched mucous or blood-clot casts of the burrows of the parasites so characteristic of the disease. The eggs were chiefly contained in these casts, but numbers were always to be found free in the urine. The secretion was always acid, and frequently deposited lozenges or spiculæ of uric acid. The blood usually, and most days exclusively, appeared in the urine voided after breakfast, the expulsive efforts of defæcation favouring both its flow and the discharge of the mucous casts. At later periods of the day the bladder was usually emptied without any appearance of blood; but if, after this was effected, the patient at any time used strong straining efforts for a few minutes, a teaspoonful of blood-stained urine, together with one or two little clots, were almost invariably ejected.

Apart from the passage of blood and the mucous strings or clots above described, and the annoyance—one day relieved and the next renewed—caused by these indications of the abiding of the parasite, there was no further inconvenience—no impediment to the flow of urine nor the slightest irritation of the genito-urinary apparatus, and the general health and activity were unimpaired.

Treatment.—Doubtful at first how high the urinary organs might be invaded, I confined my treatment for some months to the general use of henbane, turpentine, juniper, and iodide of potassium—remedies which are more or less completely eliminated by the kidneys and thus brought in contact with all parts of the urinary apparatus. Evident benefit resulted

from the use of these drugs, but at the end of six months I was satisfied that we were making no further progress in the eradication of the disease, for numbers of impregnated ova were still to be found in the urine. I therefore substituted local for general treatment. This consisted in the injection of various substances, in the form of solution or emulsion, into the bladder. The chief of these were iodide of potassium, quassia, wormwood and oil of male fern. As I am not aware of any observations on the topical medication of the bladder, I will offer a few remarks on the local use of each of these substances.

Wormwood (Artemisia absinthium), ℥v of a strong infusion of the dried plant (℥j to Oj of boiling water) were daily injected into the bladder every morning for ten days. It was retained for two, three, or four hours, and the urine when voided smelled strongly of wormwood. It was entirely without action either on the bladder or, as I soon discovered, on the free embryo of the parasite, which moved as actively and lived as long in the infusion as in water. I conclude, therefore, that this reputed vermifuge causes no annoyance to the adult Bilharzia.

Quassia.—I failed to obtain evidence as to the viability of the embryo in infusion of this wood. It was without local action on the bladder, nor did the prolonged use of the medicine appear to induce any constitutional effects. A little headache was occasionally complained of, but this was sufficiently explained by other causes. For many weeks ℥v of strong infusion (℥iv—℥viij to Oj of boiling water) were daily injected at a single operation.

Extract of male fern.—Judging from the rapid emetic or purgative action which invariably follows the ingestion of this medicine into the stomach, I proceeded cautiously, expecting that it might induce equally rapid and strong expulsive action of the bladder. I found, however, that I could inject sufficient of the extract to form a very nauseous emulsion with ℥v of water or infusion of wormwood without causing any great inconvenience. From 5 to 15 grains given in this way were, with a little effort, retained for two or even

three hours, but towards the end of this time the desire to relieve the bladder became irresistible, and the act was attended with strong expulsive efforts and followed by moderate spasmodic irritation for about an hour afterwards. The extract did not appear to be absorbed. The greater part certainly was rejected with the urine in the form of green spherules. That male fern directly affects the parasite injuriously, I have no positive evidence to show; but it acts most beneficially in exciting strong expulsive efforts whereby the ramified passages in the mucous membrane are to some extent at least cleared of the parasitic products.

Iodide of Potassium.—In a previous communication and in reference to the injection of styptics or direct irritants into the bladder, I expressed an opinion that topical treatment in this disease is out of the question, for the obvious reason that even supposing the body of the parasite lay bare upon the surface of the mucous membrane, the injection of this class of medicines would do more injury to the host than to the parasite. I therefore directed my attention to the soluble non-irritant salts with the hope of finding some which by readily permeating the mucous membrane would reach the crypts and tunnels in which the parasite lay, and which, while exerting an injurious action on the parasite would still be devoid of direct irritant action on the mucous membrane. I found iodide of potassium to possess these qualities. A solution containing five grains of the salt in the ounce fails to produce the least irritation when placed in the eye, but if a healthy leech be dropped into it, the animal immediately begins to writhe, the movements then become arrested, and death occurs in the course of an hour or so. If a leech be merely immersed in the solution for a few seconds, and then washed and placed in clean water, it remains motionless and sick for several days. Having determined thus much, I began by injecting the following every other morning:

℞ Potassii iodidi, gr. x;
Infusi quassiæ (℥iv ad f. ℥xx) ℥v.
Solve et fiat injectio.

The iodide of potassium was gradually increased to gr. xxx,

and this treatment continued for two months, occasionally substituting an emulsion of extract of male fern for the iodide of potassium.

The iodine injection was usually retained for three hours, and on one or two occasions as long as five hours. The urine then voided showed the presence of iodine on using the proper tests. The salt was readily absorbed by the mucous membrane, and the catarrhal symptoms and iodine taste caused by these large doses of the salt were at first rather severe. The patient, however, became accustomed to them, and soon ceased to make complaints. The iodide of potassium never produced the least urethral or vesical irritation. This was the medicine upon which I chiefly relied.

The injection of the bladder was readily effected by means of an india-rubber bottle holding the fluid and attached to an elastic catheter with a terminal orifice. The only precaution needed was to prevent the catheter passing further than the membranous portion of the urethra, in order that the remedy should flow over the diseased part. This was of course prevented if the open point of the instrument slipped into the bladder, in which case the injection only came in contact with the urethra, when it was returned two or three hours afterwards diluted with the urine.

After a few lessons my patient was able to inject his bladder without assistance, and he has now returned to Natal with directions to use the following injections alternately every third day :

℞ Potassii iodidi, gr. xx ;
Aquæ tepidæ, ℥v.
Fiat injectio.

℞ Sodæ hyposulphitis, ℥j ;
Aquæ tepidæ, ℥v.
Fiat injectio.

Before leaving England, I washed out the bladder by means of a double channeled catheter. Owing to the morbid condition of the mucous membrane great care is needed in this operation, for if strong pressure be used upon the bag, the return current, by flowing forcibly against the mouths of the

passages, is apt to detach small fragments of the diseased and softened mucous membrane.

I have now to speak of *the results of this topical treatment.* The first effect of the injection was to bring away a great quantity of the branched mucous casts of the tunnels formed by the parasite with hosts of imbedded eggs. Some of these casts measured more than one fourth of an inch in diameter. After a few weeks the casts lost their solid cylindrical character, and were ultimately replaced by long skin-like membranes, destitute of structure, and only here and there thickened by the usual mucous corpuscles. These casts seemed to be formed by exudation from the walls of the emptied tunnels. They were almost destitute of ova, and some of them were three fourths of an inch long. At the same time free ova nearly disappeared from the urine. These tough membranous casts soon presented an appearance which I had not before noticed: here and there they entangled masses of round or more usually oval corpuscles of pretty equal size, faint in outline, of a smooth glistening appearance, and evidently composed of excessively fine molecules of fatty matter (fig. 12). These I take to be the excrementitious products of the adult parasites.

Attached to the membranous casts numbers of laminated corpuscles—the so-called colloid corpuscles—were occasionally observed, sometimes singly, sometimes in large groups. Fig. 11 represents such a group mixed with recent ova and dehisced and collapsed egg cases. The corpuscles vary in size from that of a large mucous corpuscle to the $\frac{1}{360}$th of an inch.

Under a high power the smaller resemble starch-granules, being brighter and having more defined outlines than the mucous corpuscles. To the naked eye the largest appear like minute grains of boiled tapioca, possessing a jelly-like transparency and a faint amber tinge. They are all more readily and deeply stained by carmine than the growing mucous corpuscles. Prolonged maceration in concentrated solution of caustic potash causes no change. After soaking for twenty-four hours in fuming nitric acid (sp. gr. 1·42), a bubble of gas about one fifth the volume of the corpuscle was evolved, the latter was a little swollen, the laminæ partly disturbed

and partly effaced, and the whole imbued with the yellow tinge characteristic of the action of strong nitric acid on an albuminous body.

There can be little doubt, I think, that these corpuscles were derived from the prostate. Amongst the various morbid products described I did not fail to obtain evidence of the death and disintegration of the adult parasite.

Fig. 13 represents the structure of some fragments washed out of the urethra or bladder. One of these fragments measured 3 × 2½ lines: they were all of a dead white colour, perfectly smooth on one surface, and slightly shreddy on the other. It is unfortunate that no description of the tissues of *Bilharzia hæmatobia* exists to enable me to identify these fragments, which must belong to the parasite affecting my patient. They are composed of coarse branching fibre cells (fig. 13*a*), closely interwoven to form a compact tissue (*b*).

Thus it appears conclusively that the topical treatment was effectual in clearing away the accumulated products of the parasite, in securing their expulsion as fast as they were formed, and ultimately in destroying the adult parasite.

But some of these are doubtless more securely concealed than others, and so escape for a time the effect of the remedies employed for their removal. At the time my patient left England he still passed a few eggs of the parasite; they were all, however, imbedded, not in masses of mucus, but in soft and recently formed blood clot. The ova, moreover, were in a more lively condition, and by placing the blood clot in water and using a little pressure, the embryo was readily liberated and its structure and movements observed.

Structure and development of the embryo.—In my first paper on the parasitic hæmaturia of the Cape of Good Hope, I pointed out the similarity of the parasitic products in the cases therein narrated, to the description and figures of the *Distomum hæmatobium* given by Bilharz and Griesinger, but there still remained sufficient differences to induce me at that time to refer the objects of my study to some other species, and I provisionally called the parasite *Bilharzia Capensis*. I confess that I have never had much doubt of the

identity of the North and South African parasite, still I can only deal with facts, and my position with regard to the question is pretty much the same as it was seven years ago. The difficulty lies on the one hand, in my cases, in the almost complete concealment of the adult parasite—for as yet I have only seen fragments of the animal; and on the other, in the imperfection and insufficiency of the published figures of *Distomum hæmatobium*, together with the fact that both Bilharz and Griesinger describe and figure *two* forms of egg, the one with a terminal and the other with a lateral spine. In all my own cases I can say positively that only one form of egg has existed, viz. that with a terminal spine. Variation in the size, length, and outline of the egg is often observable ('Medico-Chirurgical Trans.,' vol. xlvii, p. 60), but I have never seen any egg with even a tendency to the formation of a side spine.

I even doubt whether this peculiar form exists in *D. hæmatobium* itself. To my mind the objects represented[1] appear to be escaped embryo masses and not eggs. Griesinger himself speaks of them as eggs or cocoons. If these two talented observers yielded this point of difference in the ova of the Egyptian parasite, then I grant that I find no difference between *Distomum hæmatobium* and *Bilharzia Capensis*.

To return to facts. As it is of the greatest importance to the residents of infected districts that the parasite should be recognised in every phase of its development, I will now conclude my observations with a full description of the living embryo, and with a statement of certain facts respecting the earliest phases of its existence.

Fig. 1 represents the ripe egg ready to dehisce and set free a living embryo. The rupture is preceded by strong writhing and retractile movements chiefly of the anterior half of the body and active movement of the cilia clothing its surface. These continue until the egg case gives way, when the animalcule is liberated more or less readily, and then it at once commences very active natatory and vermicular movments according

[1] Fig. 2, p. 562, 'Archiv für physiologische Heilkunde,' vol. xiii, 1854, Griesinger. Fig. 213 *b*, p. 622, 'Die menschlichen Parasiten,' vol. i, Leuckart.

to circumstances. The former are very rapid and graceful. Assuming an elongated, elliptical, or more commonly a cylindrical form, the embryo advances itself by a rapid undulatory action of the cilia. When the animal is actively swimming, only those cilia which clothe the shoulder (fig. 9) are usually visible, and being stronger than the rest they form a beautiful circle, by the motion of which alone, as it appears, the movements of the embryo are directed. In its progress the animal assumes a variety of forms. It often retains the original elliptical shape (figs. 2, 3, and 4). Sometimes the anterior half of the body is contracted to vermiform proportions (fig. 5); sometimes only the posterior portion is thus affected (fig. 10). More rarely the body is doubled by a transversely median constriction (fig. 7). If the animalcule meet with an obstacle the anterior third of the body may be quickly retracted as far as the line of attachment of circle of stronger cilia (fig. 6); or the whole body is still further elongated and advanced by vermicular contractions through or by the opposing object.

I have many times succeeded in liberating simultaneously from the ripe ova as many as twenty embryos, and watched their varied movements in a drop of water under a half inch object glass.

No sight can convey either a more vivid impression of the activity of animal development, or a more complete realisation of the energy of parasitic life; but how much soever our interest is excited by the sight, its attractiveness is certainly not increased by the unavoidable reflection that the tissues and fluids of the body may readily become the prey of these invaders.

The viability of the embryo in respect of temperature is considerable. I have succeeded in hatching active embryos at 42° Fahr., and after they have been exposed in the urine to that temperature for twenty-four hours.

After swimming actively about for two or three hours under the covering glass on a microscopic slide, the motions of the embryo become gradually slower and then soon cease. But even in death the little animal retains its protean character.

One of the most remarkable of its forms is that represented in fig. 8, in which there is a distinct segmentation of the body, a character which is foreshadowed in the constrictions which affect the living embryos, and which no doubt determines the regularity of these. (Compare figs. 5, 6, 7, 8, 9, and 10.)

During the life of the embryo its organization is readily observed. The anterior view of the rostrum (fig. 3 *a*) presents a depression, at the bottom of which appears two little orifices; these communicate below, each with a delicate tube which terminates, about the junction of the anterior and middle thirds of the body, in an equally delicate globular or pyriform sac (figs. 1, 2, 3, 4, &c.). At the lower and internal part of this sac a minute rounded vesicle is occasionally visible (fig. 2): it is probably the indication of an opening into a further prolongation of the alimentary canal, which, if it exist, is lost to view amongst the granular spherules which are conspicuous in the posterior half of the body. Whether the posterior continuation of the alimentary canal forms a tubular network, as in the adult distomata, is therefore doubtful, but on watching the writhings of the embryo delineated in fig. 2, in its prolonged efforts to withdraw itself from the egg case the interspherular spaces were elongated so as to present the appearance of a network of the finest tubes. To the outside of each pyriform sac a second smaller one is occasionally observable; the space included between the pyriform sacs and their tubuli is occupied by a molecular mass which during the movements of the animal undergoes strong contractions. It is probably the retractor muscle by which the anterior extremity of the body is invaginated within the body (figs. 2 and 6). In fig. 4 there is an indication of a third tube: it is probably nothing more than a cordiform condition of the retractor muscle.

After the death of the embryo the parts above described are usually indistinguishable; the cilia are rarely visible, and the body appears to be made up of a homogeneous mass of granules (fig. 10). In water the integument is detached and raised by imbibition. This is represented in fig. 11 in which the rostral aperture appears to be relaxed and dilated.

One or two interesting questions as to the primary mode in which the parasite attaches itself to the body remain to be considered. *Firstly*, for example, "does the embryo become liberated as above described within the system?" The presence of groups of dehisced egg cases in the urinary products seems at first sight a sufficient answer to this question. But it is remarkable that I have never observed the liberation of a living embryo from the egg when immersed in the urine, nor have I even met with a free living embryo in the urine. Eggs which split open and liberate active embryos immediately after they are placed in water, remain quiescent for an indefinite time when left in the urine, and all my attempts to hatch them in this fluid kept fresh and warm have invariably failed.

Again, the female appears to be incapable of receiving the disease from an infected male. The wife of one of my patients has three or four healthy young children, and the husband has been passing numbers of the eggs of the parasite every day of their married life. The lady has never had the slightest symptom of the parasitic disease, and the urine is free from all traces of the parasite. I conclude, therefore, that, if the parasites increase in the body from development of the eggs, this takes place in the nidus of solid mucus, in which they are for the most part imbedded, and that those which escape free into the urine are retarded in their development, and ultimately undergo destruction.

This conclusion is corroborated by the following experiments. Two young rabbits and two dogs were allowed to take at intervals with their food pellets of the mucus containing swarms of the eggs. Three of these animals were killed after an interval of two, three, and six months respectively, and carefully examined for Bilharzia. The dog had abundance both of Tænia serrata and T. elliptica in the intestines. Both rabbits had one or two small pyriform vesicles hanging from the omentum near its attachment to the stomach, and each of these vesicles contained a larval tænia (Cysticercus). In one of these animals I found numbers of the "*oviform bodies*" peculiar to this animal. They resemble the ova of

Ascaris lumbricoides in form and appearance, but are not one third the size, while the ova of Bilharzia are at least six times larger. The genito-urinary and biliary passages, and also the mesenteric and hepatic veins, of both the dog and rabbits were explored, but no trace of Bilharzia could be found.

I conclude from these observations, and from some other experiments which I need only allude to here, that, as a rule, Bilharzia is incapable of development within the animal body, the bare unprotected egg being the starting point.

This may, perhaps, be due to the retarded liberation of the embryo; for, *secondly*, the question still remains whether the liberated embryo is capable of maintaining its existence, and undergoing development into the adult sexual parasite within the body. I am strongly inclined to think that it may, and especially if it soon come into contact with a nourishing fluid such as the blood. At all events, this form of the parasite which so closely resembles some of the animalculæ found in the stagnant water of this country, should be carefully sought for in the water of the infected districts of Africa.

Lastly, as to the manner in which the animal gains access to the body. Is it by the mouth, by the urethra, or by the skin? My last patient, a colonist of Natal, made me acquainted with a fact which renders it possible that he, in common with many others, may have received the animal through the skin. He states that every colonist is attacked during the first year or two of his residence in the country with large indolent sores, which spread like a syphilitic ulcer and leave deep scars. He showed me two large, deep, white scars on his own body, one on the outside of each ankle.

It may be that the minute, leech-like animal fixes itself to the skin of the bather, and by means of an ovipositor implants the ova in some superficial vein, the operation being so delicately and quickly performed as scarcely to attract the notice of the individual. If such be the case, it is easy to understand that the hatching process and irritation attending the movements of the free embryos would result in an indolent form of ulceration, and that the little animals may be carried by the circulation from the ankle to the pelvis. A

careful microscopic examination of these sores from first to last would either throw considerable light on the origin of the endemic hæmaturia, or suffice to disprove the correctness of the above theory of infection. As we know nothing of the pathology of these endemic ulcers a careful account of them would, in any case, form a most acceptable contribution to pathology. (See note on endemic ulcers, Appendix.)

If such a mode of infection be possible, we may assume that it would be still more easily effected by the passage of the animal or its eggs through the mucous membrane of the stomach or rectum; and Bilharz has, indeed, associated the parasitic disease of the veins and dysentery in such a manner as implies cause and effect. In all my own cases, however, the mucous membrane has never, either by dysentery or the appearance of blood, shown the slightest trace of lesion; and hence we are led to account for a remarkable fact, viz. the localization of the disease in the genito-urinary organs. This *may* happen in the way I have just described, but it has always appeared to me *much more probable* that the animal, in one of its early forms, gets to this part of the body by the more direct route of the urethra.

The question of a general blood infection cannot be entertained, for the size both of the ovum and of the most attenuated forms of the ciliated embryo preclude its entrance into the smallest arteries or veins.

Appendix.

My friend, Dr. Symes Thompson, has told me more than once that a very intelligent medical man who has resided for a considerable time in the infected parts of S. Africa, disbelieves entirely in the existence of parasitism as a cause of endemic hæmaturia. This will in some measure explain that dearth of information on a matter of fact as plain as bloody urine itself, which has existed since the time I first made my investigations known.

It is satisfactory to me therefore to be able to adduce the following corroborative evidence from a gentleman who has

taken up the subject with the earnestness and ability requisite to clear up the gaps in our knowledge indicated in the foregoing paper. Dr. J. Vacy Lyle, of Durban, Natal, is the gentleman I refer to. I extract the following from his letter to me, dated August 25th, 1870:—

"I have for some time been engaged in collecting information on this curious disease, and have notes of a great number of cases occurring in both males and females—Europeans, Asiatics, and Kaffirs, neither of which races are free from the parasite. But the symptoms caused by it are much more severe in the effeminate Indian than in the more vigorous European and African.

"I have not yet met with a case in a resident in this town (where rain or well water is used). As far as my experience goes, the disease is confined to the rural population—to labourers, planters, hunters, and temporary residents in the country—people who are forced to use river water, or water from marshes or pools. Nor is the disease confined to a limited area, the whole coast line from the Umkomas to the Umvaloos, which flows into Delagoa Bay, nearly 300 miles in extent, is, I believe, within its influence.

"No fatal case of the endemic hæmaturia of South Africa has come to my knowledge; on the other hand, I am acquainted with more than one instance in which after a long time all the symptoms disappeared, and this without any treatment at all.[1] I write by this mail to ask a friend, who is now in London, to consult you about his daughter. I extract from my note-book the following notes respecting her:—

"Isabella G—, æt. 6½, resident in Durban, irritable, anæmic, losing flesh, passes blood in the urine; the blood is only observed in the last drops voided. Under the microscope ova of *Bilharzia* observed to be plentiful. The child

[1] On this point see my first paper, 'Medico-Chir. Trans.,' vol. xlvii, p. 65–7. The hæmaturia, indeed, ceases, but the parasite remains probably as long as life continues, and causes a new set of symptoms in some cases at least. As late as February 20th, 1871, Mr. Dunsterville, of Port Elizabeth, wrote me as follows:—"The elder of the two patients (Mr. G. D—) occasionally, nay rather

has been accustomed to visit Isabella's estate on the Umhlanga river, and whilst there to drink its water, and bathe in it.

"I regret to say our patient"—the subject of the present paper—"is not very attentive. He came once for examination since returning from England; I then found ova still existing in his urine, but few in number. His health was otherwise perfect."

Note on endemic ulcers.—The pathology of Delhi boil, which may be taken as the type of the various endemic ulcers, has lately received the attention of Staff Surgeon-Major Alexander Smith and Staff Assistant Surgeon J. Fleming (see the 'Army Medical Department Reports,' vols. x and xi). The former of these gentlemen has figured "egg-like bodies," which abound in the open sores left by the boils; Dr. Aitken, who has examined them, thinks them "quite in keeping with the extremely varied forms in which *distoma* are found in the bodies of man and animals" (vol. x, p. 334).

Dr. Fleming's figures remind one strongly of concentric growths of connective tissue, and in his last communication he appears to have resolved the objects which he formerly supposed were ova of parasites into growths of the areolar tissue (vol. xi, p. 513).

frequently, suffers from the passage of renal calculi. I enclose you some. The largest were passed after two days of suffering about a year ago, the smaller appeared at frequent intervals." It is now ten years at least since the hæmaturia disappeared in this case, and yet the eggs of the parasite occur in these calculi.

DESCRIPTION OF PLATE I.

FIG. 1.—The ripe egg, containing the ciliated embryo. × 400.

FIG. 2.—Embryo escaping from the egg shell. × 350.

FIGS. 3, 4, 5, 6, 7.—Various forms assumed by the same embryo. × 270.

FIG. 8.—Dead embryo, showing a regular tripartite segmentation of the body. × 300.

FIG. 9.—Living embryo, cylindrical form, with a similar foreshadowing of segmentation. × 300. The more distinct play of the cilia around the shoulder of the animalcule is represented in this figure, as also in Figs. 5 and 6.

FIG. 10.—Dead embryo, in which the posterior part of the body is contracted. × 270.

FIG. 10 *bis*.—Another dead embryo, in which the ciliated integument is raised by the imbibition of water, and the stomatic aperture is relaxed. × 270.

FIG. 11.—A group of laminated or colloid corpuscles of various forms and sizes, mixed with eggs and old dehisced egg cases.

a. The smallest. One of the larger is fractured, displaying the nucleus.

b. Mucus corpuscles, in which the whole of the objects delineated in Fig. 11 were imbedded; a few only are represented, in order to show the relative size of the mucus and smallest colloid corpuscles.

c. Recent ova.

d. Dehisced and collapsed old egg cases. All × 100.

FIG. 12.—Delicate molecular fatty corpuscles imbedded in membranous and stringy mucous exuviations, with mucus corpuscles adherent.

FIG. 13.—Areolar tissue, composed of—

a Large fibre cells. This is probably a portion of the integument of the adult parasite.

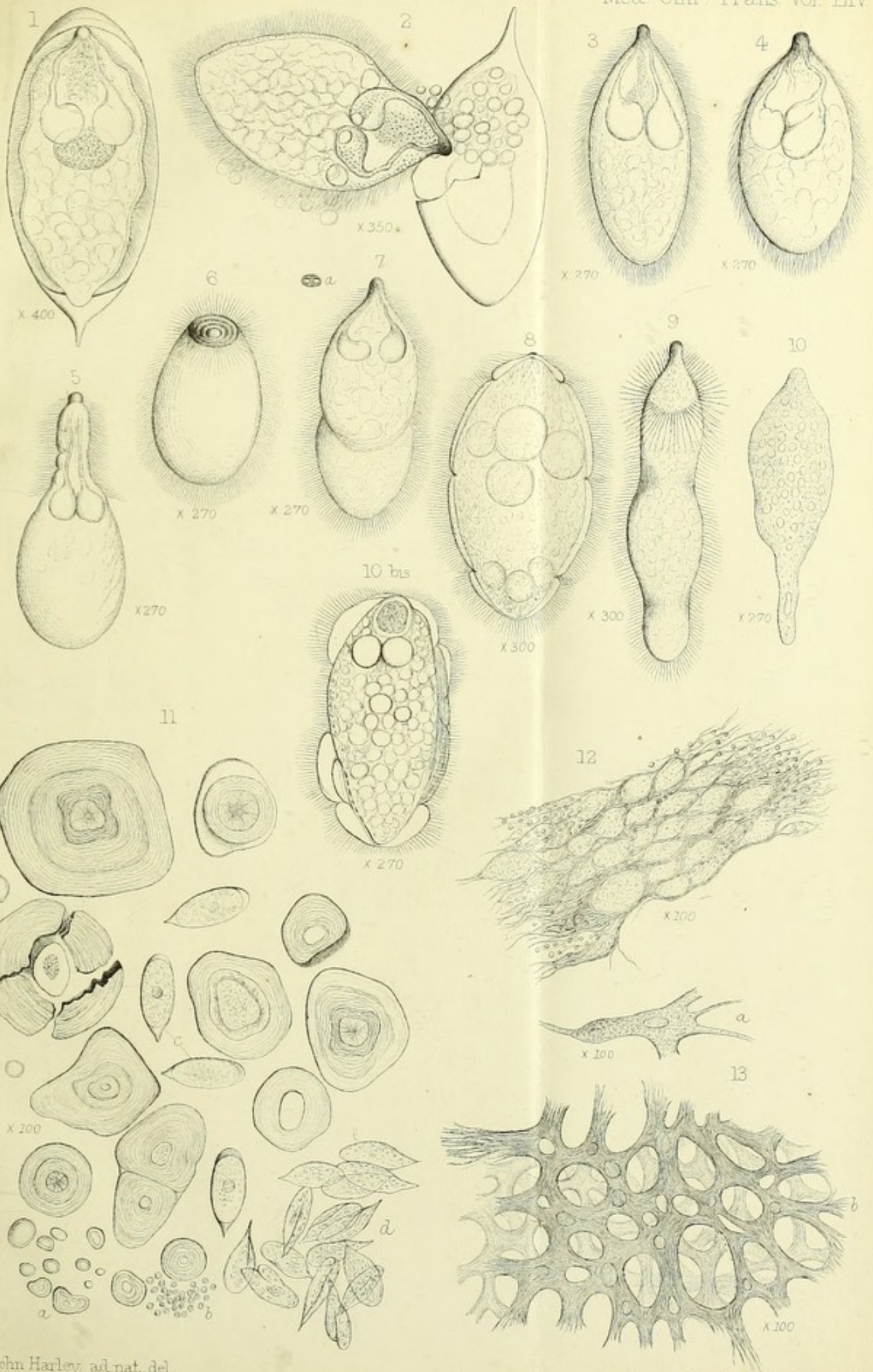

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FIG. 8.—Dea
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FIG. 9.—Liv
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FIG. 10.—De
contracted. ×

FIG. 10 *bis*.—
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FIG. 11.—A
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a. The small
nucleus.
b. Mucus cor
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the relative size
c. Recent ova
d. Dehisced a

FIG. 12.—De
branous and s
adherent.

FIG. 13.—Are
a Large fibre
of the adult par

followed me there from
that part?

Can you recollect in your
turn tell me whence
the Dengue fever came
to us from? Did it
come with the Coach?
I never had it out of
Bodily and since then
it has travelled from
Aden to Bombay and
all Arabia it has

new Recruits Burma
although not fatal it is
an irreparable Disease
and the ones of the
peaceably guide Spread
Rest with us oh
pinsenik, unless any
can find out wherever
it came -

We have the enemies
also of one of their
most Confidences of

Cholera on Record
but that came by
sea from the interior of
Africa from the direction
of the Nile Lakes.

If I can be of any
service to you at any
time I shall be only
too glad.

Believe me
Dear Sir
Yours
John Kirk

Port Elizabeth
Cape of Good Hope
June 6th/64

My dear Sir/

My friend & colleague,
Dr Rubidge of whom you have often
heard me speak is the bearer of
this note. — I feel much pleasure
in introducing him to you — After
many years of professional labor in
this Colony he is revisiting England,
with the hope of recruiting body & mind,
the former no doubt will benefit
by the home Climate, — & the latter
no doubt by revelling among the
Scientific institutions &c of which
the old country possesses so many.
Both kindred spirits in the cause of
Science, I am sure that you & he
will become capital friends & that
you will kindly assist him to a
knowledge of Scientific men & things.
He brings with him some few
matters relative to the Vertebrata
of our district — the up to the
present.

time no opportunity for a Post
Mortem has occurred which
might enable me to add
to the meagre information
we already possess on the
subject — I will not forget the
matter & send on it. — I send by
F K. — two small renal Calculi from
a Lady Ot 19 — who for years was, &
is now only occasionally attacked
with bleeding. — The stones are perfect
with the usual renal Symptoms — but
they appear to differ somewhat from
those passed by my son — who has
not suffered of late nigh so much
as formerly. ——

You will be pleased to learn that
we arrived here safely after a pleasant
passage of 37 days — but Dunsterville
thanks to you — is now perfectly restored
to health I myself remain tolerably well
& escaping the Spasmodic Cough — but I get
to work again — tho not nearly so
hard as formerly — with many thanks
for your many kind attentions.

Believe me faithfully Yours

George Dunsterville.

British Agency & Consulate.

Zanzibar

7 Oct. 1873

Dear Sir.

Your letter of 16th May forwarded by Mr. J. Smith reached me six weeks ago and where my reply would otherwise ere this have reached you but the unsettled state of Natal is still the cause, both of our lines in Eastern Africa

Regarding your enquiry

I can state that between

the years 1858 – 63.

I travelled up and

down the coast between

Hue and the Zambezi

Mouth and lived

four years in the

interior passing to

the Zambezi & above

the Victoria Falls and

on the Shore &
Lake Ontario. I
often frequently occur
the disease which I
have known & the Ague &
& the Intermittent
It's symptoms were &
are very acute &
Class & it has an
Inflammatory form &
Intermittent different

from any then
description I do not wish
here look at specimen
origin and when you
remember that then
was in 1858 and that
I did not perfect System
until 1863 keep this
to yourself without access to
Books no and without a
Microscope It is not
strange I knew

working of the Kaffir[illegible]
of the peculiar chemical
until in London Sir J.
Prater called my attention
to a paper in the Medico
Chirurgical Transactions
& then at once recognised
the character I had seen
in minute 7 -

It was peculiar crescentic
on the lower part of the
Zambezi. at Shupanga
A Senna when I the
natives name it

Tunda

~~Tunda~~ Moropa a

the passing of blood.

I treat them however

in specific disease.

I treated several cases

and found Salicylic acid

gives relief from the

symptoms but I can

not cure although at

the same time I can

cure quickly.

The disease is therefore

very rare in South

Lat. 18°.

It has been seen upwards of 6 years established in Egyptian. But are engaged as the British Govt. – my observations & observations are published but I have no doubt from what nature tell me that the Arabians exist in the peninsula.

It seems true to follow

rivers and low
marshy lands and
the absence from
mountains. that it
must be held in mind
that a traveller has
few opportunities of getting
information on such
matters I observed
not have known that
the chief Article on
the Lower Gambia had
not the same

I. Description of a *Cysticercus* of the Brain, and of a Tumour of the Ovary composed of Tegumentary Structures.

By John Harley, M.D.Lond., Assistant Physician to King's College Hospital. (An abstract of two cases read at a meeting of the Royal Medico-Chirurgical Society. Received February 12, 1867.)

The subject of the first disease was William Warren, aged 15, who died comatose after a week's illness from acute rheumatismal pericarditis and meningitis. A single cyst was found imbedded within the surface of the right corpus striatum. It contained the retracted head and neck of the larval form of *Tænia solium*—*Cysticercus*. The boy had enjoyed good health until within two months of his death. During this period he complained of frontal headache, and was frequently oppressed with an uncontrollable tendency to sleep. These were the only cerebral symptoms exhibited, and from our imperfect experience of these cases it remains doubtful whether they are to be ascribed wholly or even in part to the presence of the parasite.

Addendum.

The following case is a notable instance of direct irritation of the motor centre. A bright, healthy, strong and well-developed girl, aged about 18, and who had never suffered any illness, was suddenly overtaken with violent and prolonged convulsions: these recurred so frequently that she soon died of exhaustion in one of these terrible attacks. After a careful post-mortem examination I found a tumour about the size of a pea attached by a short fibrous stalk to a superficial vein on the surface of the left corpus striatum, and thus the cause of the convulsions was at once revealed.

To explain the absence of convulsions in the former case, we must assume that the parasite was still encysted. In this case it was free to irritate the motor centre with its minute but lion-like claws.

Explanation of the Drawing, which, though made from the first related case, applies exactly to that of the Addendum.

The head of the *Cysticercus*, the hooklets being more or less displaced from their central granular and apical bed. × 100. *a* and *b*. Granules and hooklets. × 300. *c*. A portion of the integument bestrewn with calcareous corpuscles: some are displaced and present their characteristic laminated and nucleated structure. × 300.

The drawings referred to may be found in the copy in the Library of the College of Physicians.

John Hawkins a.n.a.b.del

The next case was that of Mary Crawley, aged 35, a married woman, the mother of five children. A tumour, weighing 12 oz., was found appended to the outer end of the right ovary. It was composed of a fibrous bag enclosing a mass of solid yellowish fat, pervaded by a quantity of hair. The scalp tissue, from which these excretions were derived, formed a rounded projection into the interior of the cyst at that part where it was attached to the ovary. A second smaller projection of the same nature lay contiguous to the former; and, adjacent to both, a bicuspid tooth enclosed in a sac. Projecting from the opposite surface of the sac, and attached to a lamina of bone developed within its walls, was a second well-formed bicuspid tooth.

The left ovary contained two corpora lutea of the same age. Excepting a small long-stalked polypus, attached to the posterior lip of the os uteri, and a small follicular cyst of the same part, the rest of the sexual organs were quite healthy and the passages open.

Ovarian Cyst. Description of the Drawing.

FIG. 1.—Natural size. *a* and *b*. Cutaneous surface. *c*. A secondarily encysted molar tooth, free. *d*. A second molar tooth attached to a curved lamina of bone.

FIG. 2.—The left ovary and contained corpora lutea. Natural size.

Fig 2.

Edited by

J. Russell Reynolds M.D.

1st Edn.

ENTERIC OR TYPHOID FEVER.

By John Harley, M.D. Lond., F.L.S.

Definitive Description.—A continued febrile condition of uncertain duration, accompanied by marked intestinal derangement, and invariably associated with lesion of the solitary and agminated glands of the intestines. It commences in anorexia, with nausea or vomiting; its progress is marked by profuse diarrhœa of light ochre-coloured watery stools, associated with abdominal pain, tenderness, and tympanitic swelling; and, if the issue be unfavourable, it terminates in exhaustion, intestinal hæmorrhage, or perforation of the bowel. Death usually occurs in the fourth week. In the early period, the disease is attended by more or less pyrexia; as soon as it is fully developed, there is well-marked hectic fever. During the height of the disease, a scattered papular rash appears in successive crops on the abdomen and chest. The rapidity with which the symptoms are manifested, and the degree to which they are developed, vary greatly in different cases. The intestinal disease is frequently obscured by the concurrence of pulmonary or cerebral complications.

Synonyms.—*German*—Abdominal Typhus, Darm-typhus, Typhus gangliaris vel entericus, Ileo-typhus. *French*—Fièvre Typhoïde, Entérite septicémique, Fièvre muqueuse, Fièvre entéro-mesentérique, Gastro-entérite, Dothiénentérite, Entérite-folliculeuse. *English*—Typhoid Fever, Autumnal or Fall Fever, Slow Nervous Fever, Common Continued Fever, Hectic Fever, Infantile Hectic Fever, Infantile Remittent Fever, Entero-mesenteric Fever, Gastric Fever, Enteric Fever, Intestinal Fever, Pythogenic Fever, Cesspool Fever. *Common*—Bilious Fever, Gastro-bilious Fever, Muco-enteritis.

The above are the principal synonyms in use. Many others could be given; but as they may be either recognised as modifications of the foregoing, or have no restricted application to the particular disease under consideration, they need not be mentioned here. All may be found in Dr. Murchison's valuable work on the "Continued fevers of Great Britain," p. 385, et seq.

The appellations "Typhoid," "Abdominal Typhus," and the like, lead to an association of two diseases in the mind, which does not exist in reality; such terms therefore lead to confusion. "Gastric" has reference to an organ which, at most, only functionally sympathizes with

the principal lesion; the term "Pythogenic," introduced by Dr. Murchison, to imply the putrid source of the disease, is, on the one hand, too general, since it may be argued, with equal reason, that other acute diseases, besides the one under consideration, arise from this cause; and, on the other hand, it is not sufficiently comprehensive, since it would appear that Enteric Fever may arise from other causes than putrid or sewer emanations.

In adopting a term to distinguish the disease, we would select one which at once marks it out from all others, and points to a constant feature. Such a term is "Entero-mesenteric," employed by MM. Petit and Serres, in 1813. This appellation is a brief definition of the disease, and but for its inconvenient length we would employ it here. Acknowledging the direct sympathy which the mesenteric glands have with the intestinal lesion, we prefer, however, to use the shorter term, "Enteric Fever."

Preliminary Observations.—No disease presents, in the mode of the accession of the characteristic symptoms, in the gravity and sequence of these, and in its whole course and ending, so many variations, irregularities, complications, and accidents as Enteric Fever. A complete and consequent history of the disease will be best obtained by considering: 1st, The symptoms attending its development and progress, the condition of the secretions, and the modes of termination, the accidents, and sequences of the disease; 2dly, The morbid anatomy; 3dly, The pathology; 4thly, The associated pathology, meaning thereby, a comparative view of the development of the particular intestinal lesion in other acute diseases—an investigation of great importance in the comprehension of the relation of acute diseases generally, but one of especial value in the elucidation of the nature of Enteric Fever; 5thly, The varieties; 6thly, The distribution; 7thly, The causes; and subsequently, there will remain to be considered, the Diagnosis, Prognosis, Therapeutics, and Prophylactics of the disease.

Clinical History of the Disease.

Development and Progress.—In considering the clinical history of Enteric Fever, it will be convenient, with reference to the mode of access and development of the symptoms, to group the cases into three classes, viz. (1) Those in which the symptoms of gastro-intestinal irritation remain latent for days, or even weeks, after the patient has declined in health; (2) Those in which gastro-intestinal derangement is the chief feature of the disease from its outset to its termination; and (3) those which, in the suddenness of the invasion, the severity of the symptoms, and in the rapid course of the disease, closely resemble cases of narcotico-acrid poisoning.

Many of the cases of Enteric Fever belong to the *first class*. The disease indeed usually commences insidiously, and without premonitory indications of intestinal disorder. The decline of his health has been so

slowly progressive and uniform, that the patient cannot state precisely when his illness commenced. For days or weeks past he has lost appetite, and felt weak, languid, and disinclined for bodily or mental occupation, complaining of a little headache, chilly sensations, chiefly referred to the spine, and of weariness and pains in the limbs. His increasing weakness sooner or later compels him to relinquish his ordinary occupations, and to apply for relief. We find the tongue moist, and tolerably clean; the skin cool, pallid, and free from rash; the pulse is rather small, and slightly accelerated; the mind is clear, and the expression natural; the bowels have responded to a purgative, but now they are regular, or perhaps again constipated; the abdomen is natural; the other functions of the body are regularly performed. The patient may remain in this condition for some time, but sooner or later the nature of the disease is manifested by the appearance of its characteristic symptoms. At first, there is increase of the early symptoms, anorexia is aggravated to nausea, and sometimes there is vomiting of green fluid; the skin becomes hot and dry; the pulse is increased in frequency; the tongue is furred, and usually presents red prominent papillæ at the margins and tip; there is great restlessness and increased headache; the bowels become loose, and the abdomen is a little full, painful, and tender—the right iliac fossa especially so, and pressure upon this part usually produces gurgling. A few round rose-coloured papules may now be observed upon the abdomen, chest, or back. They disappear on pressure, and closely resemble the papules of variola during the first few hours of their existence; but they are not quite so large, nor so hard. Their number varies much, and the quantity of rash bears no proportion to the severity of the disease. Usually we do not find more than three or four papules; occasionally the chest and abdomen is closely spotted with them. In one case we observed them profusely scattered over the thighs, legs, and feet. During the prevalence of the diarrhœa a few fresh spots appear every day, and after forty-eight hours the old ones begin to fade away. Diarrhœa, frequently associated with bilious vomiting, now prevails, and the abdomen becomes distended, and in many cases more or less tympanitic; the alvine dejections are watery, and of a light ochre colour, and putrid odour. At first they are acid, but they soon undergo change, and become ammoniacal and have an alkaline reaction.

With the supervention of diarrhœa, all the symptoms become greatly aggravated; the pulse ranges between 120 and 130; the skin is often pungently hot, and occasionally attains, towards night, a temperature of 107° or 108°. During this stage there is great irritability, and often considerable delirium, especially at night. In some cases there is no delirium, and the mind remains clear to the last. Symptoms of active, pulmonary congestion,—accelerated breathing, pain in the chest, mucous râles, and expectoration streaked with blood,—are also liable to arise. The aspect of the patient is usually indicative of suffering, but the countenance is clear, and the eyes bright, as in

scarlatina; the cheeks are suffused with a hectic flush. The urine is clear and copious; it is frequently retained.

The patient may continue in this condition for several days, the body meantime undergoing rapid emaciation. The tongue may continue moist, in which case it becomes pale, large, and flabby, and is liable to ulceration about its margins, and the formation of deep fissures with everted margins across the dorsum. In many cases the tongue becomes dry, red, contracted, and fissured at this period. The mucous membranes become dry and inflamed; the gums are liable to bleed, epistaxis frequently appears, and sordes begin to form upon the dry teeth. Here is the turning point of the disease. If we can subdue the gastric irritation, and keep food in the stomach, and restrain the diarrhœa, the symptoms will usually take a favourable turn. The abdominal pain and hectic fever diminish; more nourishment is taken; the tongue begins to moisten at the edge, and the cracks to heal; the rough cuticle, especially that of the abdomen, to desquamate. Sometimes sweating is re-established suddenly, and with the appearance of a copious eruption of sudamina over the chest and abdomen; the bowels may continue loose, but the stools are of a darker, greener colour. At this stage a relapse is very common—the diarrhœa, vomiting, and hectic, returning with the former severity. The patient is not free from the danger of a relapse, until the stools have become solid. The improvement is slow, and, the diet being restricted, the emaciation persists for weeks. The desire for food is usually great; the digestive function is ultimately completely restored, and the patient regains his former weight and strength.

When the case tends to an unfavourable issue, the diarrhœa continues unchecked; the abdominal pain, and usually the tympanites also, increase; the exhausted patient lies motionless upon his side or back, drowsy or apathetic, and uttering feeble moans; the knees are drawn up, and his pinched, flushed, countenance manifests pain on the slightest disturbance; the skin is pungently hot, the pulse very fast and thready, the teeth and tongue are blackened with sordes, the continuous delirium lapses into coma—the typhous condition is complete. Watery stools are passed involuntarily, the patient hourly sinks, and at last quietly expires. As soon as the diarrhœa appears, and as long as it continues, the patient is liable to intestinal hæmorrhage. The blood may appear repeatedly and in considerable quantity day after day in the stools, or the patient may become suddenly blanched and die of syncope, without any discharge of blood *per anum*. In such a case the intestines will be found distended with blood.

Hæmorrhage, however, is not the only accident we have to anticipate. The patient is often cut off by perforation of the bowel. This dreaded event may be expected if, with a persistence of the diarrhœa, the tenderness and tympanites increase, and vomiting and hiccup supervene. Perforation is most commonly preceded by symptoms of general peritonitis accompanied by excessive tympanites, persistent hiccup,

and vomiting. A paroxysm of more intense abdominal pain sometimes indicates the occurence of this fatal result.

As an illustration of the insidiously progressive class of cases, I give the following outline of the history of a patient who came successively under the care of Dr. Murchison, Dr. Buchanan, and myself, in the London Fever Hospital.

Case 1.—C. Bushell, aged 24, a well-nourished dark-complexioned woman, experienced a feeling of lassitude, accompanied by chilliness, pains in the limbs, and slight headache, with loss of appetite, for about *four* days. She took to her bed on the *fifth* day, and was admitted on the *sixth*. A mild attack of typhus was suspected, and from day to day the tongue, pulse, surface of the chest and abdomen, and the nature of the secretions were examined. Still no positive disease declared itself, and no diagnosis was made. The pulse was 80–84, tongue natural, skin not hot and free from rash, bowels not acting every day, abdomen natural. During the time she remained in the hospital she exhibited no new symptom, complaining only of weakness, chilliness, general pains, and want of appetite. She ate fish, and subsequently meat, and was kept in bed during a portion only of the time of her sojourn in the hospital. As she was apparently suffering from mere debility, and had improved a little, she was discharged on the *fifteenth* day. She was again admitted on the *twenty-ninth* day, and stated that she had not been well since she left the hospital, having still suffered from excessive weariness and pains in the limbs, headache, and chilliness, followed by a little feverishness. Lately she has had shivering, the bowels have been rather constipated, she has lost all appetite, and feels rather sick; pulse 120, feeble; tongue moist and white; no rash; no cerebral or pulmonary symptoms. *Thirty-first* day: tongue clean and red at edges, a moist thick fur on centre; bowels became rather loose, and six or seven rose-coloured papules appeared on the abdomen; pain and gurgling in the right iliac fossa; pulse 120; skin hot; face flushed; sleeps badly. Day after day, to the *thirty-eighth* day, the purging increased, and fresh rose papules appeared; the abdominal pain increased; the tongue became dry, brown, and cracked; the pulse rose to 164. She died exhausted on the *thirty-ninth* day.

Autopsy.—Rotundity of the body preserved; lungs healthy, excepting engorgement of one lobe. Stomach, duodenum, jejunum, appeared healthy. The solitary and agminated glands of the lower part of the ileum swollen and inflamed; those near the valve were ulcerated and sloughy, and formed almost one continuous surface, raggedly disintegrated, and greatly swollen, extending around the whole of the last two inches of the bowel. A few of the solitary glands of the cæcum and ascending colon were inflamed and ulcerated. The corresponding mesenteric glands much swollen, congested, and softened. Spleen soft, twice its normal size; liver enlarged and fatty, weighing three pounds nine ounces (avoir.). Gall bladder

distended with pale brown, watery bile, of excessively acid reaction and sulphureted odour.

The *second class* of cases are perhaps the most frequent. In these the nature of the disease is manifest in the beginning. The patient may have felt a little indisposed previously; but he is in the midst of his usual occupations, or upon a journey, when he is overtaken with headache, shivering, and purging, followed by general pains and more or less pyrexia; there is complete anorexia, and nausea and vomiting are frequently amongst the earliest symptoms. There is pain in the abdomen, and great thirst. The prostration of the strength is very great, and the patient soon takes to his bed; the bowels continue to act two or three times a day, and the febrile symptoms and abdominal pain and tenderness persist; the tongue is moist, and usually coated with white fur; the edges and tip are red, and exhibit prominent fungiform papillæ. On the seventh day, or a little later, a few rose-coloured papules appear upon the abdomen, chest, or arms; the belly is a little full; there is great tenderness and gurgling in the right iliac fossa; the patient is unable to take food, and is distressed by occasional vomiting of bilious fluid. The fever runs high, there is great restlessness by day, and broken sleep and delirium at night. Great pains are complained of in various parts of the trunk, the hepatic and splenic regions are tender, and there is increased dulness in the latter, indicating enlargement of the spleen. The breathing is often quick, there is some cough, and evidence of the presence of active congestion, or of acute inflammation of the lungs, is rarely wanting at this or a little later period. The bladder is very liable to become distended at this stage. These symptoms may persist with greater or less severity for the next week or ten days, the patient passing from two to six watery ochre-coloured stools, containing a few shreddy flocculi, every day. The tongue becomes dry, with red irritable edges and tip, and elsewhere covered with a yellowish-brown cracked fur. If the patient have escaped the dangers of hæmorrhage and perforation, he may, at the end of this time, begin to progress towards recovery, or, if the symptoms take an unfavourable turn, he will almost surely die. When the purging has persisted for weeks, the days are critical. The following is a common case of Enteric Fever, beginning apparently in ordinary diarrhœa :—

Case 2.—E. R., aged 19, a well-nourished healthy woman, taken while on a journey of pleasure with shivering and purging, followed by headache and general pains. The bowels had been regular previously. The purging and other symptoms continued, and she became slightly feverish, and lost appetite. She took to bed on the *fifth* day of her indisposition, and was admitted into the hospital on the *ninth*, presenting the following symptoms :—Pulse 104, full; skin hot; tongue moist, and coated with white fur, which is disposed to form cracks; bowels very loose; motions fluid, light, ochre-coloured; abdomen tender, three distinct rounded and elevated rose-coloured papulæ here and there; there is great thirst, and the patient is very feverish.

and fretful. *Tenth* day: tongue very thickly coated, cracked in the centre, clean and red at the tip and edges; bowels very loose; stools of greenish fluid; twelve or thirteen fresh papular spots on abdomen. *Eleventh* day: pulse 96; tongue moist and superficially fissured; bowels still very loose; twenty-two fresh spots on abdomen; great pain across the abdomen and round the back. *Twelfth* day: tongue dry and brown at the tip and down the median line, aside of which it is covered with a thick crust of cracked yellowish-white fur; sides are moist and clean; stools frequent, copious, of light yellowish-brown fluid, possessing an acid reaction, and containing ragged yellowish flocculi; abdomen a little full; great tenderness and gurgling in the right iliac fossa; some fresh spots. *Sixteenth* day: the patient is emaciating very rapidly; pulse 90; tongue dry and red, devoid of fur except at base; purging a little diminished the last few days; yesterday's and this morning's stools together, darkish-brown, fluid, akaline; retention of urine, three pints drawn off; a few fresh spots, most of the old ones have faded and disappeared. *Eighteenth* day: no fresh spots; pulse 104, feeble; passes urine spontaneously. *Nineteenth* day: pulse 120; tongue dry, somewhat contracted, covered with a thin, dry, cracked, yellowish crust; much pain in the back and belly; cannot lie on the back "because it hurts her breath;" respirations 26; some fine crepitation at both bases behind; abdomen very tender; only two or three spots now visible; one copious ochre-coloured stool this morning. *Twentieth* day: pulse 136, feeble; one copious light-brown watery stool; skin cooler; sleeps well; has been sick two or three times. *Twenty-third* day: is much better; pulse 100; tongue clean and moist, excepting a dry median streak; bowels not opened for two days; the rash has wholly disappeared; hunger. *Twenty-fifth* day: pulse 80; bowels act once in two days; stools light, fawn-coloured, semi-solid; abdomen natural, bears moderate pressure; tongue moist, but furred; hunger; to take solid food for the first time—fish and bread. *Thirtieth* day: slight relapse to-day; pulse 108; anorexia; thirst; pains in limbs; headache; skin hot; abdomen painful; no action of the bowels to-day; no fresh rose spots. *Thirty-first* day: increase of the feverish symptoms; pulse 126; a little diarrhœa; stools light yellow; a copious eruption of sudamina upon the abdomen. From this date she continued to improve, and was convalescent on the *fortieth* day.

In the *third class* of cases the symptoms are so sudden and severe that there may be suspicion of poisoning by some acrid narcotic, such as colchicum or poisonous mushrooms. We find the patient in a state of high fever; there is intense heat of the head; acute delirium; frequent vomiting and purging; the tongue is red and dry; the abdomen tense and painful. We learn that his illness commenced a few days ago, with vomiting, purging, and great headache. The patient lapses into a state of stupor; the diarrhœa persists, and he soon passes into the typhous condition, and dies on the eighth or fifth day, or even earlier. The following is a good example of this class of cases:—

Case 3.—Alfred S., aged 20, a powerful well-developed man, was admitted into the London Fever Hospital, October 7, 1865, in a state of stupor, pulse 156, very feeble, tongue dry and brown, conjunctivæ injected, head hot. He lay prostrate, passing liquid stools involuntarily, and died comatose twelve hours after admission; there were no rose spots or other rash upon the skin. His friends stated that he was suddenly taken ill with sickness and purging, followed by fever and delirium. The matters voided were of a bilious character.

Autopsy.—Body well nourished, skin clear. *Head*—meninges, and brain, quite healthy; the ventricles and theca vertebralis contained only one ounce and a half of serum. *Chest*—lungs engorged, weigh three pounds, everywhere crepitant. Heart healthy, small clot in right ventricle. *Abdomen*—liver weighs three pounds three ounces, softish and flabby, a little fatty; gall-bladder distended with pale watery faintly acid bile of the colour of urine. Spleen enlarged, weighs fourteen ounces, natural in colour and consistence. Stomach slightly injected at the great end; duodenum and jejunum healthy; ileum of a violet colour externally; seven feet from the ileo-cæcal valve, a Peyer's gland, an inch long, was slightly swollen, and presented a prominent vascular elevation at one end. In the last six feet every Peyer's gland partially or wholly red, swollen, and reticulated. In the last four feet the glands were much elevated and the villous surface abraded; the larger patches were raised a fourth of an inch above the level of the mucous membrane; all were very soft, and exceedingly vascular, and of a fiery red colour. Between the Peyerian glands were innumerable solitary glands, forming elevations the size of a pea, surrounded by bright-red areolæ, and presenting yellowish unbroken apices. The intervening mucous membrane highly inflamed. The valve much swollen and deeply wrinkled. Cæcum and first foot of colon thickly strewn with swollen solitary glands as large as peas, having sloughy centres. A biliary calculus, the size of a kidney bean, lay at the lower end of the dilated appendix, which was healthy, excepting where one solitary gland formed a vascular elevation. A few of the solitary glands in the transverse colon were enlarged, with this exception the large intestine was quite healthy. The follicular glands, at the root of the tongue, were injected and swollen. The mesenteric and mesocolic glands were enormously swollen, congested, and soft. The mucous membrane of the larynx, trachea, and bronchi was very red and covered with frothy mucus; the kidneys were congested; the bladder contained eight ounces of clear urine.

The two following cases illustrate the difference in the progress, termination, and effects of the disease in different individuals under the same general conditions:—

Two young men—J. Bennett and C. Beale—of the same age, and equally strong and well nourished, and resident together in a house in the immediate vicinity of King's College Hospital, were taken ill with febrile symptoms, the former on the 14th of August, 1865, the latter a week afterwards. Both patients died; Bennett on the 12th

of September—the thirtieth day of the disease; Beale on the 13th of the same month—the twenty-third day of his illness. The rose spots were not developed in either case.

Case 4.—Bennett was admitted into King's College Hospital on the *fourteenth* day. He stated that he was attacked with headache and shivering, followed by sweating, general muscular pains, and sore throat. An aperient produced a loose state of the bowels for a day or two. Deglutition was very painful for three or four days. He got better, but remained very feeble, and did not recover his appetite. On admission he was pallid and weak, the throat had recovered, the tongue was moist, and the pulse but slightly accelerated; there was no diarrhœa, no rash, no abdominal pain or tenderness. He appeared to be suffering debility from a previous febrile attack. He continued to improve, regaining a little strength and appetite, and was discharged at the end of a week.

On leaving the hospital he went to his work, but soon felt too weak and ill to continue it, and after three days he again applied for advice, and was re-admitted into King's College Hospital on the 8th of September, when he came under my care. He was dull, peevish, and prostrate; since he left the hospital the bowels had been loose. At this date there was moderate diarrhœa. The face and skin were pallid, the latter hot, perspiring, and free from rash; the abdomen slightly tympanitic and tender. Pulse 108. Tongue dry and brown, covered with a thick cracked crust. Respirations 42; slight dullness, and fine crepitation over the back of the chest. During the next four days he lapsed into stupor, and lay on his back with the eyes closed, the knees a little drawn up, moaning occasionally, and picking with his fingers, the wrists and forearms being constantly twitched. The diarrhœa was soon checked by sulphate of copper and opium, but he resisted when attempts were made to open the jaws and administer drinks; the pulse and respirations increased, and he died comatose, four days after admission, on the *thirtieth* day of the disease.

Necroscopy nine hours and a half after death.—Body somewhat emaciated, viscera warm, blood fluid. *Chest*—lungs congested, bronchi much injected, two yellow masses of solid matter, the size of peas, like tubercle, in the lower lobe of the right lung near the border. Heart healthy, contained a pale soft clot. *Abdomen*—liver enlarged, weighed three pounds nine ounces; bile, pale, watery, small in quantity. Spleen, of natural consistence and colour, weighed ten ounces and a half. Mucous membrane of the large end of stomach much congested. Peyer's glands of the upper portion of the ileum swollen, vascular, and reticulated; all those, and great numbers of the solitary glands in the lower four and a half feet of the ileum greatly swollen and superficially ulcerated, the larger glands forming fungous elevations, with margins raised a fourth of an inch above the level of the thin wall of the bowel, and resembled large indurated chancres. Fig. 9 (p. 57[illegible]) represents one of these glands situated at a distance of 15 inches from the ileo-cæcal valve. The centres were slightly depressed,

and stained of a dirty greenish-brown colour. The swollen glands were firm and transversely wrinkled. The solitary glands formed smooth rounded elevations, the greater number corresponding in size to the tips of the fingers ; each one presented a firmly adherent central slough. Cæcum healthy, but the solitary glands throughout the rest of the large intestine, including the upper part of the rectum, formed sloughy elevations like those of the ileum. In the sigmoid flexure there were fifty-four such elevations. In the transverse colon only six. In the ascending colon they were as thickly strewn as in the sigmoid flexure. The mesenteric and mesocolic glands were greatly enlarged, vascular, and softish. The brain was not examined ; all the other organs were healthy.

Case 5.—Beale was admitted under my care into the London Fever Hospital on the 1st September. His illness commenced a week previously with anorexia, cold chills, headache, sickness, pain in the bowels, and diarrhœa. *Eighth* day : pulse 96 ; tongue moist and furred at the margins ; skin pallid and hot, no rash, no headache ; mind quite clear. Abdomen slightly distended ; gurgling in the right iliac fossa. *Eleventh* day : bowels became very loose, and the abdomen tympanitic and tender. *Twelfth* day : pain in the abdomen ; in the evening bowels very loose. *Eighteenth* day : febrile condition continues ; pulse 108 to 120 ; tongue moist and furred ; skin hot, free from rash ; face very pale. The abdominal symptoms—diarrhœa, tympanites, and abdominal pain—have daily increased in severity since the twelfth day, and to-day there is evidence of general peritonitis ; six leeches were applied to the right iliac fossa. *Nineteenth* day : leeches caused profuse bleeding, which was stopped with difficulty by the application of nitrate of silver ; pulse 132, weak ; tongue dry and brown ; bowels quiet. He gradually sank, and died on the *twenty-third* day of his illness, retaining a clear intellect to the last.

Autopsy.—Body somewhat emaciated. *Chest*—lungs weighed fourteen ounces, floated in water, contained a dirty-brown fluid. Heart healthy, contained a colourless clot in the right ventricle. *Abdomen* displayed the effects of general peritonitis, the lower part of the cavity contained about a quart of turbid serum, and the coils of the small intestine were adherent to each other, and to the lower part of the abdominal wall, by layers of solid lymph. Liver weighed three pounds and a quarter, soft, friable, and fatty. Bile moderate in quantity, of light ochre colour, watery, and very acid, instantly turning blue litmus paper bright-red. Spleen weighed ten ounces, of natural colour and consistence, but flabby. Intestines distended ; on separating the purple adherent coils of the ileum, a perforation a fourth of an inch in diameter was discovered six inches from the cæcum ; the opening in the intestinal wall was plugged with the solid lymph that adhered to the contiguous coils of the bowel, so there was no escape of fæcal matter into the peritoneal cavity. Stomach, duodenum, and jejunum healthy. Intestines contained some smooth, soft-formed fæces, varying in colour from light ochre to dirty white. Mucous membrane of

the ileum uniformly red and inflamed, covered over with tenacious firmly adherent mucus, of a bright ochre colour. The solitary and agminated glands of the upper portion of the ileum quite healthy; lower down they were vascular and swollen; two feet from the cæcum the first signs of ulceration, and in this last portion of the ileum the solitary glands were swollen to the size of a pea, and presented ragged excavated centres. The last twelve inches contained several Peyer's glands in a ragged state of ulceration, the ulcers having raised, firm, very vascular, and angry-looking edges, and irregular depressed surfaces, formed apparently of yellow sloughs, adherent to a raw, almost bleeding surface, beneath. These sloughs could be readily separated with the finger-nail. Their lower surface had a yellowish colour; they were friable, and some parts had an almost cartilaginous consistence and paler colour. After washing and careful examination these sloughs were found to be composed of solid lymph, agreeing precisely in physical and microscopical characters with the solid lymph which adhered to the corresponding peritoneal surface of the bowel. The harder and whiter portions were composed of lymph contained in the meshes of the areolar tissue of the gland, and were, therefore, really sloughs. The more advanced ulcers were seated on the inflamed and thickened muscular layer. The perforation corresponded to the centre of one of the large ulcers. The cæcum, colon, and rectum, free from inflammation and perfectly healthy throughout, and the solitary glands inconspicuous. Mesenteric glands greatly congested and swollen; those lying in the angle of junction between the large and small intestine, the size of pigeons' eggs. Pancreas hardish, but apparently healthy. Bladder empty, healthy, as were the remaining viscera.

These two closely-associated cases are interesting, as illustrating the influence of constitution upon the progress of the disease. Bennett died in a typhous state from nervous complication, and with an amount of intestinal disease at least six times greater than that to which Beale succumbed a week earlier. Yet the intestinal disease in Bennett's case was latent to within five or six days of his death; the solid thickening of the affected glands (see Morbid Anatomy) forming, and promising to continue to do so, an effectual security against perforation. One of the parents of this young man died of consumption, and he himself had evidently been affected with syphilis.

Condition of the Alvine and Urinary Excretions in Enteric Fever.—(*a*) *The Stools* are remarkable for their fluidity and the absence of healthy bile; they have a pale ochre or drab colour, and a sickly, offensive odour. On standing, a flaky matter is deposited, composed of epithelium, disintegrated sloughs from the intestinal ulcers, and undigested particles of food. According to Dr. Parkes (Med. Times, June, 1850, p. 396), the supernatant liquid has a specific gravity of 1,015, and contains about 40 parts in 1,000 of solid matter, consisting chiefly of albumen and soluble salts, particularly chloride of sodium. The stools are already in a state of decomposition, and after standing a short time are almost invariably alkaline. Immediately after they

are passed they often have a neutral and sometimes an acid reaction. The offensive ammoniacal fluid contains much triple phosphate.

If salts of bismuth, lead, silver, or copper have been administered, the dejections have a dark greenish-brown, or black colour.

(*b*) *The Urine* in Enteric Fever does not differ appreciably from that excreted in other inflammatory diseases. On the first accession of the febrile symptoms its quantity is usually diminished, but afterwards it becomes copious. As in all other febrile states, the chlorine is greatly diminished and the urea and uric acid increased. The chlorine is often reduced to a mere trace. The quantity of urea and uric acid excreted, appears to be proportionate to the degree of fever; when the pyrexia is at its height the quantity of these constituents excreted in twenty-four hours is usually doubled, sometimes trebled. As the fever declines the quantity of urea and uric acid diminish to the normal quantity or below it, while the chlorine reappears more slowly. In case 2, sixty ounces of darkish-coloured, clear, acid urine were drawn from the bladder on the *sixteenth* day. After standing twenty-four hours it was quite bright and free from deposit; specific gravity 1024. One fluid ounce contained a quantity of chlorine equivalent to 0·36 grain of chloride of sodium, 14·8 grains of urea, and ·3 grain of uric acid: or, in the sixty ounces, 22 grains of chloride, 889 grains of urea, and 18·9 grains of uric acid. On the *twenty-first* day, when the febrile symptoms began to subside, the urine was copious and neutral; specific gravity 1016·4. A fluid ounce contained a quantity of chlorine equivalent to 3·9 grains of chloride of sodium, and 5·8 grains of urea. On the *twenty-third*, the urine was copious, of specific gravity 1010, clear, pale, and a fluid ounce contained a quantity of chlorine equivalent to 3·2 grains of chloride of sodium, and 5·8 grains of urea. A small quantity of albumen often appears during the height of the fever.

Occasional Symptoms and Accidents.—Peritonitis, local or general, is liable to arise whenever the ulceration of the coats of the bowel extends deeply towards the peritoneum. This membrane becomes highly inflamed in places corresponding to the bases of the ulcers, and from these circumscribed patches of inflammation the increased vascular action may spread and involve the peritoneum more generally, and produce considerable serous effusion. Perforation is occasionally prevented by the adhesion of the inflamed patch to a neighbouring coil or coils, and if it should occur after this adhesion has been effected, a circumscribed abscess, which may ultimately discharge itself into the bowel, is formed. Perforation frequently occurs, however, under less favourable circumstances, and the fæcal matter is extravasated into the peritoneal cavity. Sudden increase of pain, accompanied by vomiting, and soon followed by cold, clammy sweats, and collapse, announce the nature of the accident. Sometimes sudden collapse alone is the only indication of this fatal issue. In other cases the perforation has taken place so gradually, the aperture formed is so small, and the extravasation so inconsider-

able, that the symptoms of peritonitis come on and attain their maximum very gradually, and without any sudden increase in the severity of the symptoms.

Perforation of the Bowel usually occurs within six inches of the ileo-cœcal valve, and in almost every case it is the small intestine which is perforated. Next to the lower end of the ileum, the cæcum is most liable to perforation. "Out of 435 autopsies recorded by Bretonneau, Chomel, Montault, Forget, Waters, Jenner, Bristowe, or made at the London Fever Hospital, perforation was observed in sixty cases, or 13·8 per cent." (Murchison, p. 511.)

Tympanites is present to some degree in almost every severe case. It usually comes on a week or nine days after the purging sets in. When excessive, it is a very grave symptom. It usually precedes perforation.

Intestinal Hæmorrhage is a frequent accident in severe cases. It was observed in twenty-nine out of 139 cases observed by Murchison, Louis, and Jenner. It is a grave symptom, inasmuch as it generally indicates deeply-extended ulceration. The hæmorrhage, however, frequently has its source in the congested capillaries of the common mucous surface, near the junction of the large and small intestines. The blood is never much changed. If the intestinal fluid be acid, it will be dark. The quantity of blood passed from the bowel does not always indicate the amount of the hæmorrhage. In the case of a young girl which I witnessed, under Dr. Todd's care, in King's College Hospital, a trifling hæmorrhage appeared, and shortly after, death occurred from syncope. The small intestines were found distended with red, clotted blood.

Retention of Urine is frequently present at the height of the early pyrexia. This condition cannot be overlooked for many hours unless there be considerable delirium.

Pregnancy.—Abortion is almost certain to occur if a pregnant woman be attacked with Enteric Fever. The only two pregnant women who have come under my care aborted, the one at the third month of gestation, the other at the fifth. Both recovered well. *Phlegmasia dolens* is apt to be a secondary complication in such cases.

Sequelæ.—Marasmus is the necessary attendant and consequent of extensive and prolonged disease of the mesenteric glands. After morbid action has ceased in these, they often become atrophied, and remain for a long time in a shrivelled, flaccid condition. In some cases the digestive and assimilating functions remain so defective that the patient fails to regain appetite and flesh, and slowly starves to death.

Imbecility.—Patients who continue long in a state of extreme emaciation commonly manifest proportionate defect of mental power. They become forgetful and apathetic.

Tubercle of the Lung is considered by some physicians to be a common sequel of Enteric Fever. Many cases presenting such an apparent sequence may be regarded as instances of tuberculosis *ab initio*. See "Associated Pathology" of Enteric Fever.

Partial Anasarca, unassociated with albuminuria, is an occasional sequel of Enteric Fever in enfeebled constitutions. *General Anasarca* is rare. A scrofulous girl, E. Gain, aged 18, lately came under my care in the London Fever Hospital, with well-developed Enteric Fever. General anasarca suddenly appeared on the thirty-fourth and thirty-fifth day of the disease, when the stools were solid, and she was convalescing favourably; she had not, however, left her bed. Œdema appeared simultaneously in the lower extremities, the face, and hands; it was preceded by acceleration of the pulse and increased heat and dryness of the skin, which was pallid, and rough from fine desquamation of the cuticle. The tongue was red and glazy, with very prominent fungiform papillæ—a condition which had existed throughout. The anasarca increased from day to day, and was associated with considerable ascites. The integuments of the abdomen and chest were very œdematous. At one time the eyelids were closed by swelling, and the patient altogether presented the same appearance as one labouring under an attack of acute dropsy after scarlatina. Simultaneously with the development of the anasarca, albumen appeared in the urine, and became very abundant. The secretion, however, retained its natural colour, and was normal in quantity, and as long as the patient remained under my care, was free from renal casts or other deposit.

Morbid Anatomy.

Wherever the source of morbid action in Enteric Fever may lie, its effects are constantly manifested in the small intestine, and it is upon the solitary and agminated glands of the lower third of the ileum that the disease usually expends its virulence.

Without positive evidence of inflammatory action in these glands, the disease would not be Enteric Fever. How far the converse of this—that inflammatory lesion of Peyer's patches is always due to a specific Enteric Fever—is true, will appear upon consideration of the Associated Pathology of the disease.

Morbid changes, consequent upon Enteric Fever, are found, (*a*) in the solitary and agminated glands of the intestine; (*b*) in the mesenteric glands; (*c*) in the spleen; (*d*) in the liver.

(*a*) *The Solitary and Agminated Glands.*—A Peyer's gland or "patch" presents in a state of health a variable number of rounded, shallow, concave depressions, averaging the $\frac{1}{10}$th of an inch in diameter, and separated by narrow linear ridges of mucous membrane, running in from the general mucous surface and on a level with it, and forming a network, in the meshes of which—*i.e.* in the depressions—the so-called "closed follicles" lie. In death, after the ninth day, from Enteric Fever, we shall rarely fail to find these and the solitary follicles in every stage of inflammation.

At the distance of four feet from the ileo-cæcal valve we shall generally find Peyer's glands in their normal condition. Six inches

nearer the valve we may find one in the earliest stage of inflammation; it is slightly swollen, and raised above the general level of the surrounding mucous membrane, and it is a little more vascular than in health.* On careful examination the swelling is found to implicate the network of mucous membrane chiefly, the ridges between the closed follicles are more vascular, wider, and more prominent than in health, and the intervening depressions are thus contracted and deepened, and the patch is more distinctly reticulated. The follicles themselves appear to remain unaltered; minutely examined under water, they have a dark, semi-transparent, violet-grey appearance, while the intervening ridges are injected with minute divergent bloodvessels. Seen at a distance, the patch is clearly distinguishable from the common mucous surface. The general appearance is that of a fine, pink or white, swollen network, with dark rounded meshes. Passing downwards towards the ileo-cæcal valve, each succeeding gland presents the above-described characters in a more marked degree, and the patches consequently become very prominent and distinct. Fig. 1 represents an agminated gland in this early stage of inflammation. It was situated thirty inches from the ileo-cæcal valve. The ridges were wide, prominent, and very vascular, and the depressions contracted and deep; at *a*, the swelling and contraction was greatest. Fig. 2 represents the next patch, nearer the cæcum. This gland was much swollen and soft, and formed a prominent, fungous-like projection of the mucous membrane. Its borders rise abruptly from the general mucous surface, and are smoothly rounded, devoid of reticulations, and slightly more elevated than the central parts of the patch. The ridges are greatly swollen, so as to convert the depressions into minute deep pits. The next stage consists in the breaking down of the swollen mucous membrane around the dark pits, and the formation of circular aphthous-like ulcers, each having for a centre a depression corresponding to a closed follicle. If this disintegration be general, the swollen gland soon presents a ragged, spongy appearance; examined under water, we find the irregular surface to be composed of a fine stroma of dirty, shreddy, fibrous tissue, containing a number of circular, rounded excavations; these are the follicles; they have not undergone further enlargement than slight thickening of their walls, which are thus rendered very distinct.

FIG. 1 nat. size

FIG 2 nat. size

* Roederer and Wagler call attention to a black dotted appearance of these glands, "resembling a freshly-shaven beard." This is the *forme pointillé* of French writers. We have frequently seen this appearance, in persons dead of disease not affecting the intestines, produced by the exhibition of metallic salts. The cellular constituents of the intestinal glands become impregnated with the iron or copper salt, and, on contact with the bile, a black sulphide of the metal is formed, dyeing these minute corpuscular masses black.

In many places the follicles are seen to be dissected-out, and only loosely connected with the surrounding shreddy tissue. The glands in the last foot of the ileum are always more or less implicated, and the innumerable and closely-placed solitary glands which form an almost continuous layer around the last two inches of the small intestine,—and which in some subjects are aggregated into one great terminal gland, the margin of which is coincident with the margin of the valve itself—never altogether escape; and usually, indeed, the inflammation appears to have expended its whole force upon the glands of this part, and we find nearly the whole circumference of the last two inches of the mucous membrane greatly swollen, and in a ragged state of disintegration. The margin of the valve is not infrequently found as thick as the lips of the subject, and this part of the bowel usually presents a dirty ashy-grey appearance, veined with blackish-purple ramifications. Some glands are merely swollen, and their turgid, everted margins overlap the contiguous mucous membrane; others are converted into ashy sloughs (*forme gangréneuse*, Cruveilhier), often deeply stained with bile, sometimes dyed with blood. In some cases the ulcers are vascular and angry-looking; in others they are pale, anæmic, and have but slightly-raised margins. Just as the inflammation does not always equally affect all parts of the Peyer's patch, so we very often find that the ulceration may be partial. A given gland may present one or several distinct ulcers. They rarely exceed the $\frac{3}{8}$ths of an inch in diameter; they have rounded, elevated borders, and at first sloughy, ragged, broken-down centres: the more advanced ones have the bare, smooth layer of circular muscular fibres, or only a little intervening areolar tissue, for their bases. In the early stage the muscular tissue is pale and free from inflammation, but sooner or later it becomes red, thickened, and soft, and soon yields to the ulcerative process. The longitudinal layer yielding in like manner, the diminishing base of the ulcer comes to lie upon the peritoneal coat. In proportion as the base of the ulcer now nears the peritoneum, so does that membrane increase in inflammation, and if the ulcers be deep and numerous, the inflamed patches become confluent, and the outer surface presents the appearance of intense inflammation, and is occasionally covered with a layer of plastic lymph. Occasionally the ulcerative process extends through the peritoneal covering, and symptoms of perforation ensue immediately, or are retarded for a time by the adhesion of solid lymph exuded upon its outer surface. The aperture formed in the peritoneum rarely exceeds three lines, and it is almost always formed within a distance of six inches from the ileo-cæcal valve. Sometimes the whole patch is converted by the confluence of smaller ulcers into a single deep ragged one, the sharp and perpendicular edges of which irregularly excavate the red, tumid mucous membrane immediately surrounding the diseased gland.

Occasionally the inflammatory process does not pass so soon into the gangrenous or ulcerative stage, and the glands become firmer and more

prominent; the reticulations are completely effaced by the swelling, and the surface of these expanded, mushroom-like projections has a granular appearance (*forme granuleuse*, Cruveilhier). Glands in this condition may be restored to their natural state by resolution, or they may pass into the subsequent stages of gangrene or ulceration. The "*Plaques dures*" of Louis, which "a' l'incision offrent une section ferme, lisse, et brillant," are very rarely observed in Enteric Fever distinguished from tuberculosis. In upwards of thirty fatal cases which I have examined, I have found this condition in only one (case 4), and in this I am inclined to attribute it to syphilitic taint. Fig. 9 represents one of the chancre-like Peyer's patches from case 4: *b* will serve to convey an idea of the uniform thickening of the gland, overlying the unaltered muscular and peritoneal layers.

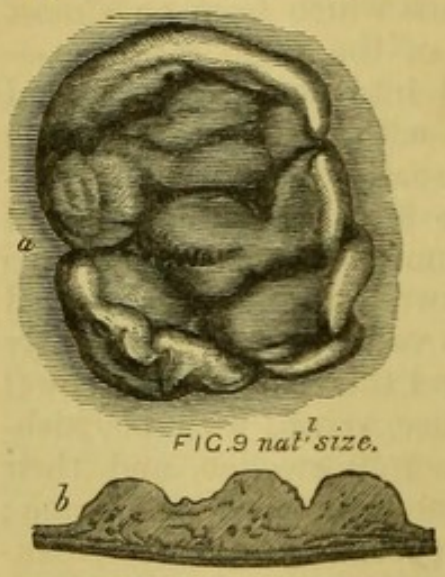


FIG. 9 nat. size.

The solitary glands of the small intestine, and frequently also those of the cæcum and ascending colon, share more or less in the above-described changes. These minute glands occur in increased numbers towards the ileo-cæcal valve, where they become closely aggregated. Placed beneath the mucous membrane, and attached to its under surface, they lie loosely imbedded in the submucous areolar tissue, and in their healthy condition are hardly perceptible.

In many cases of Enteric Fever we find the last two feet of the ileum strewn with minute, round, semi-transparent elevations, varying in size from a mustard to a hemp seed. These are the solitary glands in a state of inflammation. In this early stage of the inflammatory process they have the appearance of a fine miliary eruption, and constitute the condition known as "*Psorenterie.*" When the solitary glands attain a larger size, and become a little harder and more opaque, the mucous membrane appears as if studded with pustules (*forme pustuleuse*, Cruveilhier). This appearance gave origin to the idea that Enteric Fever was "intestinal Variola." These swollen glands, however, are almost always solid: in only one case have I observed them to contain a yellow pultaceous matter, resembling inspissated pus.

If all the solitary glands be involved in the inflammatory process, the mucous membrane is thickly studded with them, and in the last two feet of the ileum, the distance between them will average about the $\frac{1}{8}$th of an inch. When an aggregation of a few solitary glands is swollen, a stud-shaped elevation is usually formed.

According to my own observations the solitary glands are affected in proportion to the severity of the inflammation of the Peyerian glands.

In very rare cases the solitary glands alone are affected in Enteric Fever.

In many cases the disease is equally developed in the small intestine and cæcum; once I have seen death from perforation of the cæcum. Occasionally the large intestine is more extensively ulcerated than the small. In case 19, for example, the small intestine escaped, and the inflammation affected the solitary glands of the large intestine almost exclusively.

In proportion as the solitary glands are inflamed and swollen, they cause a projection and thinning of the mucous membrane. Attentively examined under water with a pocket-lens, they are seen to be of a delicate pink colour, and exhibit a minute dark central point. Occasionally the swollen gland presents a yellowish summit surrounded by a minutely injected areola of converging bloodvessels. Ulceration commences by the softening and abrasion of the mucous membrane around the summit of the gland, the disintegration then becomes deeper, and spreading outwards, minute circular ulcers, with sloughy, shreddy centres, and purple, tumid margins, are formed. These ulcers rarely exceed the $\frac{3}{8}$ths of an inch in diameter. Their further progress is identical with that of the ulcerated agminated glands, and they are equally liable to produce hæmorrhage and to perforate the bowel. In most cases we find a few of the solitary glands of the cæcum and large intestine thus inflamed and ulcerated. Occasionally the glands of the large intestine are more or less implicated along the chief part of its extent, and by the confluence of the small ulcers very large ones are sometimes formed in the cæcum and ascending colon. The direction of these ulcers is generally transverse. In Enteric Fever, ulceration always commences in the solitary or agminated glands, and if these were the only "follicular glands" in the intestinal canal, the term, "Follicular Enteritis," by which Enteric Fever has been distinguished, would be a very suitable one.

We have now to consider the *nature* of that morbid process, the effects of which have been described. From the description just given, it is clear that the process is an inflammatory one. Usually there is evidence of very acute inflammation. It will be inferred from the foregoing description of the diseased glands that the inflammatory products are formed around the closed follicles, and not in their interior. Very careful observation leads me to speak positively on this point. If the new material were formed within the closed follicles, as Goodsir concludes, the follicles would indeed "become much distended," and, as a result, they would form projections upon the surface of the Peyer's patch, which I have never observed to be the case. On the contrary, I have always found them in the earliest stages of the inflammation to be placed far below the swollen ridges of mucous membrane and submucous tissue surrounding them, and in the latter stages, the follicles are completely buried beneath the inflamed surface of the patch, and concealed from view, and it is only when the excessively vascular and turgid ridges of the mucous membrane and subjacent tissue are disintegrated, that the follicles are again discovered, lying deeply in the abundant submucous tissue, and exhibiting little

or no increase of size. The parts immediately surrounding them appear to have undergone considerable disorganization; for the follicles are often dissected from the surrounding parts, and remain attached to them by only a few tough fibres. In health, each follicle is surrounded by a close network of bloodvessels, which, as far as I have observed, chiefly constitute the wall of the little gland; from this parietal network other branches, exceedingly fine and delicate, pass towards the centre of the parenchyma. If the vascular excitement be moderate, the central, as well as the circumferential parts of the gland may increase in size: but usually the inflammation is acute. Cut off from all other parts of the circulation, and surrounded by inflamed vessels, congestion and stasis would very soon occur in the delicate vessels which pervade the parenchyma; and thus, whilst the parts external to the follicles would be increasing under the influence of the inflammation, the central parenchymatous parts would undergo no increase, but would tend to atrophy and disintegration. Hence the formation of centrifugal ulcers and sloughs around the follicle; and such indeed must always be the results of inflammation in parts which have a similar arrangement of bloodvessels within them.

Structure and Characters of the Inflammatory Product.—This we find to be cellular. On examining vertical sections of Peyer's patches in the early stage of inflammation, represented in fig. 1, we find that the submucous tissue is composed of a very loose network of very elegantly waved and reticulated fibrous tissue, from which the so-called walls of the closed follicles are not defined. The meshes of this network are filled with finely-granular corpuscles of various sizes, chiefly spherical, and averaging the $\frac{1}{3000}$th of an inch in diameter. (Fig. 4). A few cells of adipose tissue, arranged in single rows, are occasionally seen. Sections through the more advanced and ulcerated patches present the same arrangement of the fibrous stroma; the cells are equally numerous, but they are a little larger, and of more uniform diameter, averaging the $\frac{1}{2100}$th of an inch, and a little more darkly granular. (Fig. 5.) Here and there a corpuscle is observed containing one or more spherules of oil. Sections of the firmer swellings (*forme gaufrée*), and of those in a more advanced stage of ulceration show that the corpuscles undergo fatty degeneration, and subsequent molecular disintegration. In these we observe multitudes of enlarged corpuscles containing spherules of oil, and much intercorpuscular molecular matter. (Fig. 6.) Rokitansky speaks of "the deposition of a typhous product" in the inflamed glands. The swelling, according to my own observation, is due to the rapid growth of the corpuscles

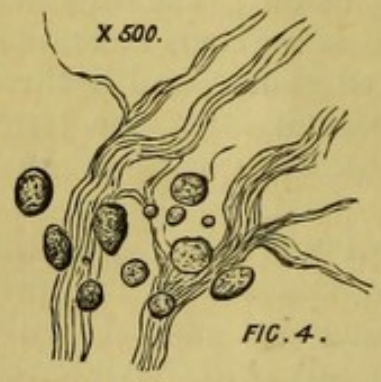
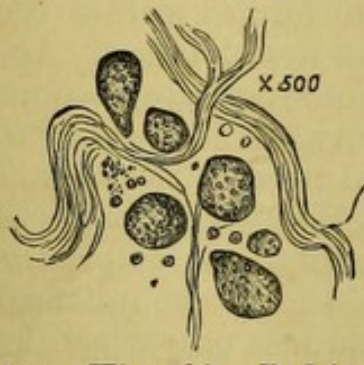


FIG. 4.

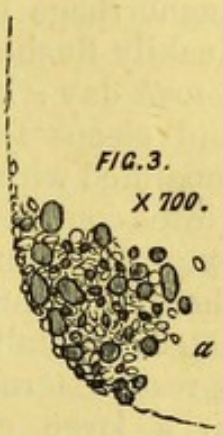
FIG. 5



forming the parenchyma of the glands, whether Peyerian or mesenteric.

Not infrequently fibrinous exudation forms upon the surface of the ulcerated gland (case 5), or amongst its cellular constituents (case 4). Sections of the gland, which I have delineated in fig. 9 showed the elements represented in fig. 6, interspersed with minuter corpuscular matter and molecular fibres.

The *villi* upon the diseased patches and contiguous mucous membrane have a smooth outline and are denuded of their epithelium. They present a finely granular appearance, due to the presence of innumerable homogeneous, yellowish-tinted, refractive granules, which average the $\frac{1}{5000}$th of an inch in diameter. Some attain the $\frac{1}{2500}$th of an inch; others are mere molecules. Fig. 3 represents a minute portion of such a villus highly magnified.



Stages of the Local Disease.—Since the disease is usually developed so very insidiously, it will be difficult, and in the early stages impossible, to predicate with certainty the actual condition of the intestinal glands. The following generalizations, however, may prove useful (see also Diagnosis). For the first *nine* days the glands are undergoing inflammatory swelling, and at the end of this period they will be found projecting three or four lines from the mucous membrane, in the form of red, or purplish, fungous, soft excrescences, free from erosion. If death occur any day before this period we shall find the glands more or less advanced towards this condition. About the *tenth* day the inflammation either subsides or increases. Resolution is effected in the usual way by diminution of the vascularity and swelling. If the inflammation increase, the swollen glands become a little firmer, and on the *eleventh* and *twelfth* days present softening and erosion of the mucous membrane covering them. *Fourteenth* day: circular disintegrations around the follicles; a spongy, sloughy appearance of the abraded patch, which is frequently stained of a deep ochre colour by the bile—the formation and separation of ashy sloughs. *Sixteenth* day: complete separation of the sloughs, leaving ulcers limited below by muscular fibres or peritoneum, and surrounded by red, swollen margins of mucous membrane; erosion of bloodvessels, and hæmorrhage. *Twentieth* day: cicatrization begins. *Fortieth* day: cicatrization completed.

Reparation of the Intestinal and other Lesions.—In those who have died during a relapse of Enteric Fever, or at an advanced period, of pulmonary or other complication, we may often observe the process of reparation of the local disease. The following case exhibits the condition of the abdominal viscera during recovery from a severe attack of Enteric Fever, with pneumonia. The patient died of gangrene of the cheek (cancrum oris) and lungs.

Case 6.—Joseph Taylor, aged 15, came under my care, August 15,

1865. He had been ill *three* days with headache, nausea, diarrhœa, and fever, and presented on admission all the symptoms of well-developed Enteric Fever (without rose rash, which never appeared), and pneumonia of the left lung. On the *sixteenth* day: pulse 144; respirations reduced to 28; diarrhœa and abdominal tenderness somewhat abated; dulness and fine crepitation over both bases of lungs behind. Three black sloughs, the size of peas, have formed in the mouth, two on the gums and the third on the centre of the left cheek. *Nineteenth* day: Pulse 162, hardly perceptible; tongue dry and brown; bowels very loose; passed a considerable quantity of blood in the stools to-day; slough on the cheek spreading; cheek hard, and swollen. *Twenty-second* day: pulse 144; moderate intestinal hæmorrhage every day; diarrhœa restrained; cheek much swollen, duskily flushed, hard, and shining; respirations less frequent. *Twenty-fourth* day: bowels quieter; no more hæmorrhage; takes drinks well and sleeps fairly; slough of cheek extending, those of the gums separated with the loss of two molar teeth. *Twenty-sixth* day: remains quite conscious and takes drinks well. The left cheek is livid externally, and the eyelid closed by the swelling. From this date the pulmonary and abdominal symptoms declined, and the bowels acted naturally, the stools becoming solid. The gangrene, however, spread externally, and involved all the central parts of the cheek in a large circular slough, and the patient gradually sank, retaining a clear intellect throughout the disease, and died on the *thirty-second* day.

Autopsy.—Body much emaciated. *Chest*—lungs weighed together twenty-four ounces; apex of the left gangrenous, and partially broken down; lower lobes of both firm, slightly crepitant, pale-red, friable—recovering from pneumonia—here and there a small circular ashy slough; no trace of tubercle. Heart healthy; blood fluid; right internal iliac vein, at its junction with the cava, firmly plugged with a yellow, friable clot. *Abdomen*—liver weighed two pounds six ounces; firm; lobules indistinct, with a whitish speckling in the form of minute stellæ; the gland did not appear to me to be fatty, but microscopic examination showed the cells to be greatly enlarged, destitute of pigmentary matter, and replete with oil. Bile abundant, pale ochre-coloured, watery, acid. Excepting a few patches of minute injection of the mucous membrane of the stomach, the alimentary canal was healthy to within four feet of the ileo-cæcal valve. This lower portion of the ileum was much injected and dark red. At four feet from the valve, a small Peyer's gland, the lower end of which presented a round, gently-elevated swelling, with a central irregular excavation the size of a hemp seed, limited externally by the healing, granular margin of the pink mucous membrane. Three inches lower down, a larger gland, the lower half healthy, the upper with four cicatrizing ulcers—three so far healed as to be converted into minute stellate chinks, surrounded by pale-red, wide, smooth borders, scarcely elevated above the surface of the healthy portion of the gland. Below this

gland were nineteen minute cicatrizing ulcers, chiefly of the solitary glands, all with rounded, smooth, very soft vascular borders firmly attached to the less vascular transverse or longitudinal layers of muscular fibres, which formed clean, smooth bases to all the ulcers. Next occurred six large ulcers caused by the destruction of the whole of the large Peyer's glands of this part; they formed large, smooth, and soft, interrupted depressions, limited below by the very distinct reddish-grey muscular fibres, and surrounded by pale-red, raised, and rounded sinuous borders reposing upon the muscular layer: two or three of these ulcers presented rounded islets, or projections of smooth, red, mucous membrane running in from the raised border of the ulcer, and on a level with it. (Fig. 10.) One of these large patches presented a minute contracting ulcer at either end, the intervening space being occupied by a smooth, greyish-white, opakish, slightly-depressed membrane. Nearer the ileo-cæcal valve were thirty-one other ulcers chiefly affecting the solitary glands, and varying in dimensions from mere linear chinks to the three-fourths of an inch. All were in process of cicatrization. In the next portion of the ileum—the last four inches—there were a great many similar ulcers, all clean and healing, but not quite so far advanced in this process as those situated higher up. There were three small and distinct healing ulcers in the colon, the last one situated at the distance of a foot from the cæcum. The cæcum, and rest of the large intestine, including the rectum, were perfectly healthy. The solitary glands were all visible and marked by a central black dot just as they appear in the meconium-stained bowel of a newly-born infant.

The mesenteric glands were, for the most part, as large as almonds, and so flaccid that they could scarcely be distinguished, in the mesentery, between the thumb and finger: they were of a dusky-grey or ashy colour, and of an almost leathery toughness. Entire sections of them could be readily made, and these were as tough as fibrous membrane, and presented an abundant, finely fibrous stroma, the ordinary corpuscles, and a considerable quantity of highly refractive granules.

The receptaculum chyli and thoracic duct were collapsed and empty. The spleen weighed five ounces and a drachm; it was of natural consistence, and presented a bright reddish-brown colour on section. The remaining viscera were apparently healthy.

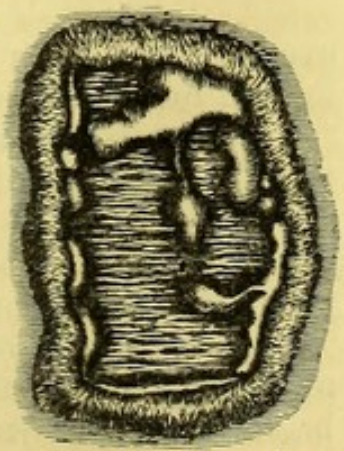


FIG. 10 nat size.

Floated under water, the rounded vascular borders of the healing ulcers presented a double margin, the villi are seen to terminate in a wavy line, and from within and below the border so formed projects the paler and quite smooth soft border of advancing granulations. (Fig. 10.) Some of these spring up from the base of the ulcer, and form islands, which ultimately become confluent with each other and the margins of the ulcer, to form a smooth, depressed mem-

brane, which always remains destitute of villi and of closed follicles. In some of the cicatrized ulcers, we occasionally observe a little cluster of closed follicles, but this simply points to the fact that a portion of the closed follicles of that particular gland escaped injury. After these follicles have been removed in the inflammatory process they are never regenerated. Years after an attack of Enteric Fever the ulcerated Peyer's patches will be found to be replaced by pale, smooth, slightly-depressed, but unwrinkled membranes, which are more firmly adherent to the muscular layer than the healthy gland, and remain permanently destitute of villi.

(*b*) *The Mesenteric and Mesocolic Glands.*—Just as inflammation of the tonsils induces vascular excitement and swelling of the lymphatic glands, situated about the angle of the jaw, so does inflammation of the solitary and agminate glands excite inflammation in the corresponding glands of the peritoneal folds. The swelling of the latter is always proportionate to the degree of the intestinal irritation; the glands, therefore, which lie in the angle of junction between the small and large intestine are those most affected. In every case of Enteric Fever we find the mesenteric glands are more or less congested, swollen, and softened. They are usually of a dark purple colour, and of the size of hazel-nuts. Some often attain the size of a walnut. Bisected with a sharp scalpel, the outer portions are seen to be of an uniform dark purple colour, the central parts are less vascular, and the yellowish-white parenchyma is veined with diffuse purple streaks, and a mottled appearance thus produced. The parenchyma seems yellower than usual, but this is simply the effect of contrast. The gland is so soft that it is difficult to make a thin section of any extent. Microscopically examined, we find it to be composed of an exceedingly delicate, friable, scarce stroma of indistinct fibres, and of molecular corpuscles of various sizes. These latter constitute nearly the entire gland; they are for the most part spherical and nucleated: the most numerous average the $\frac{1}{3000}$th of an inch in diameter; the larger present well-formed nuclei, and average the $\frac{1}{2300}$th of an inch in diameter. (Fig. 7.)

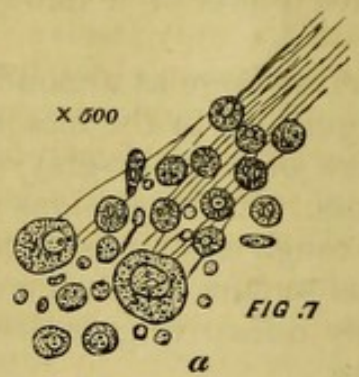


FIG. 7

In the subsequent progress of the disease the glands may return to their normal condition, or the cells may break down to a creamy fluid. In one or two cases this puriform fluid has increased to such an extent, as to rupture the peritoneal covering of the gland, and general peritonitis has followed the extravasation of its contents.

As soon as resolution of the inflamed, and cicatrization of the ulcerated glands of the intestine have taken place, the mesenteric glands begin to decrease, and become for a time shrunken, flabby, and tough.

In those cases in which I have made the necessary examination, I have found the receptaculum chyli and thoracic duct empty and collapsed.

(*c*) *The Spleen* is severely congested in almost every case—probably during the inflammatory period of the disease—in every case. It is usually enlarged to twice or thrice its natural size; occasionally it is found four or five times larger and heavier. Its colour is uniformly purplish-black throughout, and it is so soft and friable that it may be reduced to a semifluid pulp with the greatest ease. Minute granular corpuscles, fibre-cells, and molecular branched fibres are the only structures I have been able to detect under the higher powers.

(*d*) *The Liver.*—A morbid condition of this organ and its secretion has been very generally observed. Forget does not specially mention the condition of the liver in many of his cases. Of others he records the following observations: "Liver normal, gall-bladder containing much, or little, thin bile," obs. xlv. xlviii. lv. "Liver voluminous, possessing a fatty appearance," obs. lx. "Liver voluminous, gall-bladder almost empty," obs. lxviii. "Liver presented a little softening in its right lobe, the gall-bladder contained a thin bile, slightly coloured, like water," obs. lxxiii. The liver was softer than natural in thirty-two out of seventy-three cases examined by Louis, Jenner, and Murchison. (Murchison, p. 555.)

Louis states that the *volume* of the gland was augmented in $\frac{1}{10}$th of his cases, and in these it had lost its consistence; the *consistence* was diminished, the tissue of the organ being sometimes soft, sometimes friable, in the majority of his cases, and in none did it appear to him to be firmer than natural; *softening* existed in nearly half the cases, and in four to such a degree that the fingers sunk into the gland substance without resistence; the *colour* was natural in only twelve of the subjects examined by him; it was redder than usual in eight, five of which were examples, more or less marked, of sanguineous engorgement. This appearance was noticed a little more frequently in those who died at an early period—from the eighth to the twentieth day. The *bile* was sometimes red and very fluid in different degrees in about half the cases; in ten, it was more abundant than usual. (Louis, Rech Fièvre Typhöide, vol. i. p. 269 et seq.) Another careful observer, Grossheim, remarked, that in all the cases observed by him, "the liver never retained its normal colour, and the bile was always much thinner and clearer than in the healthy state. It was frequently transparent, sometimes clear yellow, sometimes of a dirty whitish colour; in quantity, it was sometimes normal, rarely increased, but most frequently of all it was so diminished that scarcely any was left." (Edinburgh Med. and Surg. Journal, 1837, vol. xlviii. p. 178.) Stannius examined twenty-three fatal cases of Enteric Fever. "In the majority, the liver appeared to be of normal consistence and colour; not infrequently it was softened generally or partially. Almost always, both in those cut off at the height of the disease, and in those destroyed at later stages, the gall-bladder contained pale-yellow, or yellowish-green, often watery mucous fluid, not reddening litmus paper or tinging the skin." (Ibid. p. 174.)

My own observations agree with the foregoing; but as to the fre-

quency with which the liver is found in a morbid condition, I am led to conclude that the gland *never* escapes without some alteration in its texture. In every case which I have examined, I have found the liver in a more or less advanced state of fatty degeneration, and in almost every case, noted an increase of weight. Even when the gland is of normal size and to all appearance healthy, or only a little pale, microscopic examination will show very considerable degeneration of the hepatic cells. In case 1, above recorded, the liver cells were greatly enlarged, averaging $\frac{1}{1000}$th of an inch in diameter, and frequently containing spherules of oil the $\frac{1}{2000}$th of an inch in diameter. The bile in this case had the low specific gravity of 1018 and strongly reddened blue litmus paper. After depositing an abundant pale ochre-coloured granular-looking matter, composed of columnar epithelium, it had the colour of whey, or pale urine with a faint greenish tinge. I have constantly found the bile thin, watery, and easily filterable; in one case the specific gravity was as low as 1011·2. Filtered, and evaporated on a water bath, such altered bile yields only a small quantity of black solid matter, greenish-brown, by transmitted light, and wholly soluble in water. The bile itself, or this solution, gives slowly and faintly, sometimes imperfectly, the characteristic reactions of bile when tested with the mineral acids, or Pettenkofer's test. The bile has a strong post-mortem odour, and in one case which I examined twelve hours after death, when the viscera were still warm, and the blood steamed on exposure to the frosty air, it smelt strongly of sulphuretted hydrogen.

The morbid changes, above described as affecting the intestines, the mesenteric glands, the spleen, and the liver, are the constant and essential lesions of Enteric Fever. We now pass on to a cursory examination of such morbid phenomena as are exhibited by the other organs of the body.

Tongue.—The general condition of this organ has been described. The characteristic features are, unusual redness of its edges, with enlargement and prominency of the fungiform papillæ, in the early period of the disease; and a wrinkling and cracking of the dry glazed surface, with contraction and reddening of the whole organ, at a later period. The cracks are very painful and often bleed. If the tongue remain moist, it is usually flabby, indented, and covered with white fur. In this condition it occasionally presents spreading ashy ulcers upon the tip and sides; and sometimes deep fissural ulcers, with pale everted margins, form across the dorsum. When nervous symptoms predominate, the tongue becomes covered with a thick, brown, firmly-adherent crust, very dry and hard, and reticulately fissured.

In several cases, I have observed great congestion and swelling of the follicular glands at the base of the organ.

The Lips and orifices of the *nostrils* are often cracked and inclined to bleed.

The Tonsils are rarely affected; abscesses have been observed in them in a few cases.

The Pharynx and Œsophagus.—Louis found small round or oval ulcers of the mucous membrane of the lower portions of the pharynx and œsophagus in about a sixth of his cases.

The Stomach, Duodenum, and Jejunum are usually healthy. In some cases they present morbid conditions, such as softening and minute ulcerations of the mucous membrane, which are common to all inflammatory diseases.

The Pancreas.—I have usually found this gland harder, and with the lobules more distinct, than in health, as if shrunken. Otherwise it has appeared healthy.

The Urinary and Generative Organs are in the normal condition, or only slightly congested.

The Epiglottis, Larynx, and Trachea are occasionally ulcerated. The mucous membrane of the bronchial tubes is usually red and swollen.

The Lungs present in almost every case evidence of pre-existing inflammation. (See Associated Pathology of Enteric Fever).

The Muscular System.—Agreeably with what is observed in other protracted diseases of an acute character, the muscular tissue is found to be liable to degeneration in Enteric Fever. Zenker (Veranderungen der Muskeln in Abdominal Typhus, 1864), describes two forms of muscular degeneration—granular and waxy. The granular form consists in the deposition of minute highly refracting granules in the contractile tissue, giving to the fibres a dark appearance by transmitted light and obscuring the striæ. This molecular deposit is not wholly composed of fat. The degenerated fibres are very friable. The waxy form consists in the transformation of the sarcous tissue into a homogeneous colourless mass, glittering like wax and causing a complete obliteration of the striæ and nuclei of the fibres, the sarcolemma remaining intact. The waxy cylinders, thus formed, crack up into numerous fragments, which crumble down into a finely granular detritus, and this is gradually absorbed. The muscles most liable to degeneration are the adductors of the thigh, and the abdominal recti. The affected muscles are of a pale greyish-red colour. Rokitansky observed rupture of the abdominal rectus in Enteric Fever, and attributed it to spasm. Virchow noticed rupture of the muscles associated with friability of the muscular fibres in four cases of Enteric Fever. Zenker noted eleven such cases, all of which occurred in Enteric Fever. The rupture occurred most frequently, but by no means exclusively, in the rectus abdominis, transversalis abdominis, pectoralis minor, triceps brachii, and psoas. The author last mentioned attributes the rupture of the muscles and extravasation of blood into their substance, to the degeneration of the fibres above described. The rupture tends to produce hæmorrhage, and this leads to the formation of collections of sanies or pus, which must be distinguished from general pyæmic deposits. Abscesses in the muscles are very rare in Enteric Fever.

The Skin presents us with one of the characteristic symptoms of Enteric Fever, the "*tâches roses lenticulaires*" of Louis. These spots

closely resemble the papules of variola during the first few hours of their existence, but they are not quite so large nor so hard. They form slight rounded discrete elevations of a pale rose colour, which fades away at the base, forming a moderately distinct circular outline. Each rose papule is a minute circumscribed inflammatory centre, from which the blush disappears on pressure. These spots usually appear on the abdomen and chest alone, but they are often found on the back. They are seen occasionally on the face and upper and lower extremities. The eruption is not always present. "Of 1820 cases admitted into the London Fever Hospital during ten years, it was noted in all but 224, or 12·3 per cent." (Murchison, p. 470.) The rash usually appears on the supervention of the acute febrile symptoms. It may be looked for at the end of the first week, and may continue as long as the febrile symptoms and diarrhœa persist. The total number of spots rarely exceeds fifty ; in some cases they are innumerable. There is no relation between the quantity of the rash and the severity of the symptoms. It appears in successive crops ; at first only two or three spots may be observed, next day four or five fresh ones, the next as many more. Each crop persists for a few days and then disappears. According to Barthez and Rilliet, and Murchison, the spots are fewer in children than in adults ; and the two former observers state that in the same class of patients they are oftener absent in the severe cases than in the mild. These rose spots occasionally appear in other acute diseases. In a severe case of typhus in a powerful fair-complexioned man I noted a very copious eruption of rose papules upon the chest and abdomen ; they preceded the typhus rash, and had wholly disappeared when this became petechial.

The departure of the fever and the re-establishment of the cutaneous function is often announced by the eruption of *sudamina* over the whole of the chest and abdomen.

Roughness and minute desquamation of the cuticle, especially that covering the abdomen, are observed after the cessation of febrile symptoms in severe cases. The desquamation occurs independently of the pre-existence of sudamina, which alone is sufficient to produce it.

The temperature of the skin usually undergoes a progressive increase during the first fourteen days of the disease, attaining, in severe cases, 104° subject to the morning and evening vacillations, which are observable in other febrile conditions. If the abdominal or pulmonary symptoms undergo no amelioration, this temperature is often maintained during the early part of the day. When the intestinal inflammation proceeds to extensive ulceration, this high temperature may persist continuously for weeks, and undergo an increase of 2° or 3° during the hectic exacerbations which take place in the evening. Recovery in such cases is attended by a gradual diminution of temperature. In more favourable cases the resolution of the inflammation is declared by sudden falls of temperature.

When the fever is prolonged, the pungently hot skin becomes very harsh, and the papillæ as prominent as in the *cutis anserina*.

The Lymphatic Glands are usually only secondarily affected in cases complicated with ulceration of the pharynx and erysipelas of the surface. In young children, suppuration of the cervical glands about the angle of the lower jaw, is not very uncommon: three such cases have lately come under my care. Parotid inflammation, which is so common in typhus and in scarlatina, is rare in Enteric Fever.

Nervous System.—The only lesions discoverable are slight sub-arachnoid effusions, fulness of the bloodvessels, and slightly increased vascularity of the cerebral substance.

Circulatory Organs.—In protracted cases the muscular tissue is liable to fatty degeneration, and this change becomes first apparent in the left ventricle of the heart.

The Blood.—M. Trousseau, in speaking of intestinal hæmorrhage in Enteric Fever, says the blood is exhaled by the mucous surface, as occurs in hæmatemesis, epistaxis, &c. "The proximate cause of this sanguineous exhalation," he goes on to say, "is a profound alteration experienced by the blood, which is found in that state which one has termed the 'state of dissolution.'" (Clin. Med. p. 230.) M. Forget examined 123 specimens of blood, derived from patients in all stages of Enteric Fever. Of the blood drawn during the first period of the disease, only about $\frac{1}{18}$th of the specimens presented appreciable softening. In the second period $\frac{1}{7}$th of the specimens exhibited this change.

He concludes generally that an appreciable alteration of the blood in the several periods of Enteric Fever cannot be accepted as a general fact; that the blood is rarely altered in the first period; that the alteration is more marked in proportion as the disease is more advanced; that the alteration is not always in proportion to the gravity of the disease. (Forget, sur l'etat du sang dans l'Entérite folliculeuse: Gaz. Médicale.)

My own observations of the condition of the blood of those who have died from Enteric Fever, accord with those of M. Forget. In subjects dead in the third week of the disease, I have frequently found firm colourless clots of fibrin in the heart and roots of the great vessels. In protracted cases the blood not only becomes very thin, but is also much diminished in quantity, from sheer inanition.

Pathology.

If we carefully regard the incipient symptoms of Enteric Fever, we shall find that they have reference to derangement of the hepatic function. Often, long before the graver symptoms are developed, the patient loses appetite, the bowels are constipated, and the stools pale; the tongue is foul, and the digestion much impaired. All these symptoms point to a defective secretion of bile, and to a state of approaching inanition. Such a torpid condition of the liver may be produced in two ways in the development of Enteric Fever. It may result from severe or prolonged vascular congestion,

in which the other internal organs participate ; or it may be the effect of some morbific agent, carried by the portal vein from the intestinal surface into the liver, and causing, by a direct action upon its secreting corpuscles, derangement, or more or less complete paralysis, of its functions.

If in any case a poison be not decomposed in its passage through the alimentary mucous membrane, it must of necessity be admitted into the liver. We know how readily mineral poisons are conveyed and arrested there, and we recognise the effects of certain vegetable substances upon the hepatic secretion. From these facts, and from its situation between the intestinal and general circulations, we may reasonably conclude, that it is one of the offices of the liver to arrest noxious matters in their way from the portal into the general circulation, to neutralize or decompose them, or to eliminate them from the blood, and throw them out again through the bile ducts into the intestine.

The very admission of deleterious agents into the portal circulation, must lead, by diminishing the reciprocal attractions of the portal blood and the hepatic corpuscles, to congestion of the whole portal circulation.

Thus prepared, and by that concurrence of related actions which we everywhere witness in the body, the congested capillaries of the intestinal mucous membrane relieve themselves by a copious watery exudation, by means of which the poison set free by the liver is washed out of the alimentary canal. Such probably is the mode of action of elaterium, colchicum, &c. But it is the special function of the liver to prevent putrid decomposition within the body. If therefore the function of this gland be depressed, as in a case of simple vascular congestion from exposure to cold, for example, a septic poison may be generated within the body, and set up all the symptoms which follow the introduction of a similar poison from without. Doubtless, so long as the liver is in an active healthy condition, any septic poison taken into the alimentary canal would generally be neutralized, but if the gland should happen to be torpid at the time, then the unaltered poison, upon admission into the liver, would possibly arrest the secreting corpuscles in the elimination of that very fluid which has the power of rendering it innocuous. How little is known of the derangements to which the liver is liable, and of the alterations which its secretion undergoes! We readily obtain evidence of the grosser irregularities of the kidneys, but we can judge of those affecting the liver only by the colour of the fæces—a good general guide, no doubt; but how rarely is this means of diagnosis available in the incipient stage of diseases!

Primary vascular congestion of the liver, no matter how produced, leads to a vitiation of the secretions of the alimentary canal; nervous exhaustion results from arrested nutrition. Under these conditions the liver begins to degenerate, and the intestinal mucous membrane tends to ulcerate, the blood is imperfectly depurated, and general febrile

disturbance ensues. Surely if high fever, violent delirium, and coma, are the consequences of acute suppression of the bile, the pyrexia, headache, and the most severe delirium which ever accompanies Enteric Fever, may be fairly attributed to that diminution and derangement of the hepatic function which invariably accompanies this disease.

That the liver is early and gravely deranged in Enteric Fever is proved by the facts already mentioned in the morbid anatomy of the disease, and by the prominency of those symptoms which have led observers in all ages to designate it by the terms "bilious, gastro-bilious," &c.

In place of a thick, heavy, alkaline secretion, rich in biliary acids and colouring matter, we find a watery, neutral, or often excessively acid bile, notably deficient in its essential constituents, and sometimes putrid at its very source. M. Trousseau considers the flux from the bowels to be of the nature of a specific catarrh. But what is the *nature* of this specific catarrh? Is the bowel endeavouring to supply defective action of the liver by carrying away, in some unformed state, constituents of the blood which that gland should have removed as glycocholic and taurocholic acids? We do not think such a theory necessary. At the commencement of the disease there is probably some attempt at elimination, but in the subsequent stages we believe that the diarrhœa and intestinal lesions are rather due to congestion and mere local irritation than to any specific cause. This would appear to be the case from consideration of the fact that if we restrain the diarrhœa—the assumed means of elimination—we do not aggravate the general symptoms, but positively ameliorate them; and in most cases marked improvement follows the complete arrest of the diarrhœa.

Not the least important function of the liver is to prevent by its antiseptic properties the decomposition of the chyme; take away this preservative influence altogether from the system, and fermentation with the escape of gas and tympanitic distension follow. The impure chyme irritates the debilitated and congested mucous membrane, and what wonder then if inflammation, ending in ulceration of Peyer's patches and the follicular glands, should result?

But why should these particular structures suffer more than any other parts of the intestinal canal? For two reasons, we think; first, on account of the greater vascularity of these glands, whereby they most readily participate in local congestion and, as has been shown, the arrangement of bloodvessels within them, which, when the circulation is obstructed, renders them liable to sloughing; and secondly, on account of their delicate cellular structure, for in febrile conditions it is the active growing corpuscles of the parenchymatous organs which most readily participate in the inflammatory process.

That the glands of the lower three feet of the ileum should be most affected, may perhaps be regarded as a significant fact, and it is one for which it is difficult to find a satisfactory explanation. Anatomy

will not allow us to ascribe a difference in function between the solitary and agminated glands lying near the junction of the small and large intestines, and those removed to a greater distance from it; nor do we find that the glands of the upper and lower parts of the ileum have such a difference in their immediate associations as would account for unequal participation in general disease; and we should, therefore, be led to assume that if the solitary and Peyerian glands were employed in some general process connected with the elimination of a blood poison, they would all be similarly affected. Such, however, is rarely or almost never the case in Enteric Fever, for the Peyerian glands of the lower third of the ileum are almost always found in a state of extreme inflammation when those of the upper two-thirds exhibit no morbid change, and we never find Peyer's glands of the upper portion of the ileum ulcerated when those of the lower are uninflamed.

The following considerations may afford some explanation of these facts. *First:* there appears to be a greater tendency to congestion of the lower than of any other portion of the ileum, due to the greater number of vascular solitary and agminated glands situated there, and also to the manner in which the small and large intestines are united. The abrupt fold forming the ileo-cæcal valve is similarly constituted to the anal sphincter, and, like it, necessarily causes some arrest in the flow of blood beyond its margins. We recognise, therefore, a predisposition in the lower part of the ileum, to participate in inflammatory action. *Secondly:* if we now regard the derangement which exists within the digestive canal, we may be able to find an exciting cause in the altered action, which doubtless results from disturbance of the reciprocal action of parts engaged in the same function, but separated from each other by a considerable distance. Can we, for example, attribute the lesion of Peyer's glands in the lower portion of the ileum to defective action of the glandular apparatus situated in the higher portions of the alimentary canal? The liver, we have found, secretes bile, deficient in those essential constituents which exert an important influence upon the digestive process. The defective bile probably contains sufficient of these constituents to maintain healthy action in the upper portion of the small intestine, but becoming exhausted of these in the lower, it there fails to exercise any antiseptic influence, and of itself induces unhealthy action.

But, it may be argued, if this were the true explanation of the lesions of the small intestine, how is it that the large bowel escapes, for according to the theory, we should expect to find that the intestinal lesions would progressively increase from the lower third of the ileum downwards, instead of being confined, as is usually the case, to the lower third of the ileum and cæcum? The frequent immunity of the large intestine from any considerable participation in the disease, may be explained by supposing that the irritation set up in the lower portion of the ileum by the vitiated bile, causes such a copious exudation of fluid from this part of the alimentary canal, that the irritating matter is diluted, and at the same time so rapidly carried

away through the great intestine, that the lower portion of the alimentary canal usually escapes any severe implication in the intestinal lesion.

There can be very little doubt that the dejections in Enteric Fever are chiefly thrown off from that part of the intestinal canal where the inflammatory irritation is greatest—viz., the lower portion of the ileum. The cæcum, where the secretions are necessarily retained for a time, is often as gravely affected as the last six inches of the ileum. In some cases, moreover, the large intestine is often severely involved in the disease, and occasionally, as we shall have an opportunity of showing, it is exclusively affected,—a fact quite consistent with the theory here advanced. *Thirdly:* the localization of the intestinal disease may be supposed to arise from derangement of that particular part of the sympathetic nervous system, which is distributed to the lower portion of the ileum, just as destruction of the eyeball may follow injury of the orbital branches of the fifth nerve. Morbid anatomy fails, however, to reveal such derangement of the sympathetic plexuses, and if it did, there would still remain the difficulty of accounting for a general febrile condition in such limited defect of nervous action. The question naturally arises to every inquirer whether the symptoms of Enteric Fever are to be attributed to general blood-poisoning, or whether they secondarily arise as a consequence of a localized intestinal lesion. From the foregoing observations it will be seen that we are induced to conclude that the disease arises from a vitiation of only a portion of the venous blood, and that the constitutional symptoms are in many cases due to consequent derangement of the hepatic function. If we accept this view we shall be at no loss to account for the great variation in the *nervous symptoms* observable in this disease. Some patients retain a clear intellect to the last hour of their lives (*e.g.* cases 5 and 6); others lapse into a state of stupor or coma at a very early period of the disease (*e.g.* case 3); and the majority manifest great nervous irritability and prostration, and at some period or other, more or less delirium. In every case there can be no doubt that the derangement of the digestive, cutaneous, and pulmonary functions, results in an impure condition of the blood; but we consider that in many cases the nervous symptoms are due rather to nervous exhaustion from inanition, or to active meningeal congestion, rather than to a specific blood-poisoning. The delirium partakes very much of the character of delirium tremens, and there is frequently very notable vascular excitement of the cerebral circulation. In those cases in which the cerebral symptoms are predominant, we are forced to recognise a general blood-poisoning, and then the question arises, is this due to more or less complete suppression of the hepatic function, or to the admission of a specific poison into the general circulation? Probably it may be due to both of these causes. If the poison be arrested by, and thrown out from the liver, no general blood-poisoning, and, therefore, no grave nervous symptoms, may ensue. If the liver be

unequal to the arrest and elimination of the poison, it passes unaltered from the portal into the general circulation, and symptoms of general blood-poisoning at once appear; and if the gland be so far deranged in the process of elimination as to become almost paralyzed in its function, more or less complete suppression of bile would be an additional cause of the cerebral symptoms.

Associated Pathology of Enteric Fever.

Pneumonia.—The lungs and the intestinal and mesenteric glands manifest very great sympathy in morbid action. In two, at least, out of every three of the many cases of pulmonary phthisis which I have examined, I have found the solitary and agminated glands of the lower portion of the ileum and the mesenteric glands, more or less infiltrated with tubercle, and the former often very gravely ulcerated. The same sympathy is observed when the lungs are the seat of common inflammation, and in pneumonia we shall very often find corresponding inflammation of the solitary and Peyerian glands of the ileum. Reciprocally, of all the complications of Enteric Fever, pneumonia is the most common. In some stage or degree, I believe, it is very rarely absent. In many cases the inflammation does not proceed beyond active congestion, the post-mortem evidences of which are engorgement with some friability, and the so-called "splenization or carnification."* According to the observations of Louis, inflammation of the lungs is more frequent in Enteric Fever than in any other acute disease. He found that splenization, simple or complicated, with partial inflammation of the lung in the first or second degree, existed in twenty out of forty-six cases of Enteric Fever, and in seventeen there was actual inflammation. In only fifteen cases were the lungs healthy, or their alterations slight, little extended, and consisting chiefly of change of colour, due apparently to diffuse or partial congestions. Thirty-eight of his forty-six patients had cough at some period or other of the disease. (Louis, Recher. Fièvre Typhoide, vol. i. p. 330 et seq.) These observations of Louis are in accordance with those of every other observer. In upwards of thirty cases examined by myself, I have found the lungs free from the effects of more or less extensive inflammation only twice. The following case shows the intimate association of the two diseases. It is given by M. Forget as an example of "Follicular Enterite of the inflammatory form:"—

Case 7.—"A strong woman, aged 23, after exposure to hard work in the open air, experienced a sense of painful weariness, headache, nausea, vomiting, thirst, shiverings followed by heat, &c. *Third* day: diarrhœa. *Fourth* day: face flushed; skin hot and dry; pulse frequent, large, resisting; respiration frequent, without cough or pain; tongue white at the centre, red at the edges; abdomen indolent; two liquid

* M. Louis does not consider "splenization or carnification" as the result of inflammation, but such a condition developed during a general and continued febrile action cannot be regarded as being wholly independent of the inflammatory process.

stools to-day. *Fifth* day: tongue red, denuded; meteorism; a liquid stool in the night. *Sixth* day: pulse 120, a little nocturnal delirium, dyspnœa, thoracic sibilance. *Seventh* to the *twentieth* day: continued in a typhous condition, with purging, dyspnœa, and more or less delirium. *Twenty-first* day: delirium, groanings during the whole night, deglutition difficult, several liquid stools, pulse frequent, thready; dyspnœa extreme; death.

Necroscopy. — *Head* — notable injection of meninges. *Chest* — old pleuritic adhesions; both lungs engorged—a condition which appeared to have existed for some time—indurated, friable behind and at the bases. *Abdomen*—partial injection of the mucous membrane of the stomach and intestines. Towards the cæcum, were met with, at first fine reticulated and swollen Peyer's glands, then rounded ulcerations, which became confluent, confused, fungous in the neighbourhood of the ileo-cæcal valve and upon it: large intestine also presented traces of inflammation and numerous ulcerations, smaller, but more numerous than in the small intestine, and occupying almost its whole length. Mesenteric glands engorged, brownish. Spleen slightly enlarged, friable. Walls of the mouth and pharynx covered with a white pultaceous matter. (Traité de l'Entérite Folliculeuse. Obs. lv. p. 414.)

In this case diarrhœa and dyspnœa appear to have commenced simultaneously. The patient died of pneumonia. Take away disease from the one lung, and truly we have, as far as the symptoms and morbid changes are concerned, a typical case of Enteric Fever. Are we, therefore, to attribute the lung disease in this case to a specific *typhoid* poison, the presence of which must be assumed to be proved by the intestinal lesion? Or may we not regard the pneumonia and enteric disease, as mere local manifestations of one common inflammatory condition, probably produced by cold? We are inclined to adopt the latter view. In the outbreak of Enteric Fever in the two companies of soldiers under Dr. Grossheim's care, this acute observer could find no other cause for the disease, but "the violence and continuance of the military exercises, and the necessary exposure to great cold after being overheated by violent and laborious corporeal exertions." (Edin. Med. and Surg. Jour. vol. xlviii. p. 187.)

For the association of pneumonia and Enteric Fever, see also cases 6 and 19.

Pleurisy is almost as often present in Enteric Fever as pneumonia. Dr. Murchison observed recent adhesions, or effusion of lymph, in six out of nineteen cases; Dr. Jenner, in six out of fifteen; and M. Louis, in two out of forty-six; but he found a greater or less amount of reddish, serous effusion in the pleural cavities in nineteen other cases. (Murchison, p. 560.)

Case 8.—Julia Hatch, aged about 30, died of pleuro-pneumonia on the *forty-fifth* day of the disease. She was admitted into the hospital on the *fourth* day, when the following note was made:—Pulse 120, tongue moist and furred, skin cool and moist, face flushed, respiration accelerated, slight dulness on percussion, and pleuritic friction sound at

the base of the right lung behind ; bowels regular. She improved, and took food with a relish until the *twenty-fourth* day, when the pleurisy attacked the left side ; the febrile symptoms increased, respiration became hurried and oppressive. A second blister and mustard poultices were applied to the chest, and on the *thirty-sixth* day pulse was 144, feeble ; respiration much easier ; face less livid ; tongue clean ; mucous crepitation and fricton sound still heard, both before and behind, on both sides. Eats mutton-chops well. After this date she continued to get worse. On the *forty-first* day, pulse 144 ; respirations 50, laboured ; skin hot and very dusky ; dulness, crepitation, and friction sound still heard. She continued in the same state till the day of her death. The condition of the skin, tongue, and abdomen was carefully noted from day to day, but, throughout, the digestive function was most regularly performed, the bowels acted naturally every day, and the motions were perfectly healthy. Considering her febrile condition, her appetite for food was unusual. On the *thirty-fifth* day she asked for meat, and enjoyed it. The abdomen was flat and natural, and there was never any appearance of rash.

Autopsy. — Body considerably emaciated ; abdomen flat. *Chest.*— costal cartilages partially ossified; extensive pleuritic adhesions on both sides, some of which were old, others evidently the result of the last illness ; lower lobe of right lung adherent to the diaphragm and side of chest, soft, friable, and slightly crepitant, evidently recovering from recent inflammation. No trace of tubercle in any part of the lungs. Heart healthy, containing soft, yellow clots in the right cavities. *Neck*—fibrinous and serous exudation in the areolar tissue, around the trachea, and between the muscles in front of it. Slight œdema of the mucous membrane above the glottis, and redness of the trachea. Follicular glands at the base of the tongue much enlarged, with violet, swollen, everted margins and gaping orifices. Tonsils a little enlarged. Uvula much swollen. *Abdomen*—intestines undistended and undisturbed ; the coils of the small intestine dark purple. The whole of the ileum was intensely inflamed, and every Peyerian gland swollen and prominent. Those in the lower three feet of the bowel, and also the intervening solitary glands, were greatly swollen and ulcerated—whole patches being excavated into ragged ulcers, with rounded, everted, intensely vascular borders, overlying the contiguous mucous membrane ; the irregularly excavated centres were deeply stained with bile. One ulcer, two inches from the ileo-cæcal valve, alone extended to the muscular coat, exposing a smooth surface, half an inch in diameter, of soft, swollen, muscular fibres. The non-ulcerated patches formed elevated fungous-like expansions. Many of the enlarged solitary glands were deeply excavated at the centre. The intervening mucous membrane was excessively vascular. The cæcum was congested, the large intestine healthy, and contained well-formed, solid, bright, yellowish-brown fæces. Mesenteric glands much enlarged, congested, and soft. The spleen, liver, kidneys, supra-renal capsules, and organs of generation, were perfectly healthy. The

gall bladder was full of healthy, green, viscid bile. Although the patient was subjected every day to close scrutiny, there was no suspicion of intestinal mischief at any time; there was not the faintest external indication of it, but the reverse. I examined the case chiefly with the view of ascertaining how far Peyer's glands are affected in acute disease, and I was surprised to find ravages much more extensive than are seen in ordinary cases of Enteric Fever, and such as would be considered to be eminently typical of this disease.

Laryngitis is a rare complication of Enteric Fever. I have noted it in two cases. In one it occurred during the height of the disease, and yielded to leeching and blistering. In the other it came on during convalescence. Suffocation impended for two days, but the patient escaped by the ejection of fragments of a tough, organized membrane.

Scarlatina and Diphtheria.—A very close relationship appears to exist between these diseases and one variety at least of Enteric Fever. All are, for the most part, autumnal diseases, and they may be observed to increase and decrease together, and all appear to arise spontaneously out of the same conditions. Stöber, Löschner, and Friedleben maintain that scarlatina and Enteric Fever prevail epidemically in an inverse ratio to each other, the one prevailing in proportion as the other declines. (Brit. and For. Med.-Chir. Rev. July, 1858, p. 162.) I have known several instances of scarlatina or diphtheria affecting one member of a family and Enteric Fever another, simultaneously. The day before C. B. (case 1) came into the hospital, her brother, aged 14, was admitted with "scarlatina in its most marked form." Sore throat, accompanied by the exudation of white pultaceous matter, upon the mucous membrane of the fauces, frequently accompanies the early symptoms of Enteric Fever (*e.g.* cases 4 and 7). Diarrhœa is often a severe complication in scarlatina and in almost every fatal case of this disease, inflammatory swelling of the solitary and agminated, and of the mesenteric glands will be found. After most careful microscopical examination of these swollen glands, I have failed to distinguish the slightest difference between them and those of the first period of Enteric Fever. Scarlatina, I have reason to believe, often lapses into Enteric Fever, and such appears to have happened in the case of Julia Hatch (case 8.) I have described this case under Pleurisy, but it is probable that its appropriate place would be under Scarlatina. I failed to get information as to her previous history, but the condition of the glands at the root of the tongue, and the neighbouring inflammatory effusions, correspond exactly to the effects of scarlatina. Dr. Murchison noted the co-existence of scarlatina and Enteric Fever in eight cases, and the appearance of scarlet rash without sore throat in five other cases (pp. 518, 473). Other observers have frequently noticed the same facts. Barthez and Rilliet noted the co-existence of diphtheria and Enteric Fever in six cases, Forget in two, Louis in three, and Murchison in one.

The following case of "malignant scarlatina," associated with the anatomical lesions of Enteric Fever, is related by M. Forget :—

Case 9.—A strong man, aged 20, after his usual work, was seized with shivering; during the night, sensation of constriction in the throat, headache, fever, &c. *Third* day: carried to the hospital; hands, forearms, thighs, and chest, 'offrent une belle coloration scarlatineuse;' skin burning hot; pulse 140, small; tongue red, and covered, as well as the mouth, with a white, pultaceous coating; throat painful; deglutition very painful; no diarrhœa; chest normal. *Fourth* day: partial stupor; eyes injected; coloration of skin persists; sudamina; pulse 160, thready; pultaceous coating of mouth diminished; back of throat very red, swollen; deglutition almost impossible; epigastrium tender; death.

Necroscopy.—Head—meninges injected. *Chest*—lungs engorged throughout, a little friable at the summit; heart filled with white clots. *Abdomen*—gastric and duodenal mucous membrane red, manifestly inflamed; small intestines presented, on approaching the cæcum, numerous Peyer's glands, of which some were simply dotted black, others were reticulated; the majority were red, swollen, firm, elastic, and prominent (gaufrées); an abundant miliary eruption (psorentérie) in a great extent of the small and large intestine, including the rectum.

"Ces caractères anatomiques, sont tous ceux de l'entérite folliculeuse très développée, avant la période de gangrène et d'ulcération." (Forget, Obs. xix. p. 144.)

On the next page but one, the same observer gives the history of a case of "scarlatine suive d'entérite folliculeuse."

Such is the association which subsists between scarlatina and Enteric Fever—an association closer and more frequent than is observed between the former and any other acute disease, and one which compels us to acknowledge some closer connexion than mere accidental intercurrence.

Tracing the connexion still further, we observe that the physiognomy, the character of the febrile action and delirium, and the condition of the tongue; are the same in both diseases. In both there is a tendency to epistaxis, cracking of the lips, desquamation of the cuticle, and dropsy (see Anasarca). In the one disease, the solitary and agminated glands of the upper part of the alimentary canal (the tonsils and intervening follicular glands of the tongue), and the neighbouring lymphatic glands, are affected; in the other we find the corresponding parts (the solitary and agminated glands of the ileum, and mesenteric glands), of the lower portion of the alimentary canal, diseased. Whether, therefore, we consider these two diseases in reference to their origin, their mode of development, or their physiological anatomy, we still find in either case a resemblance between them. It is only in their subsequent progress that we recognise a clear distinction.

This distinction has reference, *first*, to the nature of the contagious

poison—scarlatina tends to spread as scarlatina, and contagious enteric fever as Enteric Fever; and *secondly*, to the progress of the two diseases,—the one falls upon the cutaneous surface, the other upon the mucous. With regard to the first point, there is nothing in the history of the contagious diseases—at least of the diseases here compared—to dissuade us from the assumption that the contagious animal poisons are developed within the body, and derive their specific characters from the particular actions to which they may happen to be there subjected. Thus, for example, putrescent substances admitted, on the one hand, in a volatile form by the respiratory surface into the *arterial* blood, may be conceived to undergo, during the process of absorption, some special and definite change, whereby a specific poison is formed: and, on the other hand, if the same deleterious agent be taken in a liquid or solid form into the alimentary canal, and thereby admitted into that limited portion of the *venous* system—the portal circulation—we may reasonably assume that it may be peculiarly modified by the agency of the digestive secretions, so as to constitute, upon its admission into the blood, a poison different from that formed in the lungs, but somewhat related to it in its action.

But even assuming that the septic agent be not so diversely modified in the process of absorption, we may still find an explanation of the differences which ultimately distinguish the two diseases if we consider that, in the one case, the liver, a most potent converting agent, intervenes between the portal and systemic circulations, and that by its agency the skin and kidneys—the arterial organs most affected in scarlatina—may be in a great measure protected from a poison introduced by the alimentary canal If the septic poison be simultaneously admitted into the blood by the lungs and intestinal surface, a mixed disease—scarlatina complicated with Enteric Fever, or the converse—may upon this theory result.

Those who have seen most of these two diseases, and have studied them side by side, will, we feel sure, be most ready to acknowledge how soon their distinctive characters become lost in the intermediate modifications which are observed to occur between them.

The allied affection, croup, is also an occasional associate of Enteric Fever. The following case is taken from M. Louis's work on typhoid fever:—

Case 10.—*Croup.*—A powerful man, aged 23, was attacked with slight pain in the throat, preceded by fatigue, lowness of spirits, anorexia, thirst, diarrhœa, and slight epigastric pains. *Third* day: shivering, heat, and sweating; diarrhœa each day very considerable; no sensible increase of the pains in the throat. *Fourth* day: considerable diarrhœa. *Seventh* day: considerable epistaxis; pains in the throat; soft palate red, without swelling; deglutition difficult, and often excited; a sense of prickling and heat in the affected part. *Eighth* day: pain in throat continued; a shining semi-opaque false membrane upon the tonsils, sides of the uvula, which is inflamed, and upon the pharynx; voice a little changed; pain and difficulty of deglutition; four stools

and copious sweats during the night; some lenticular rose spots upon the abdomen. *Ninth* day: false membrane more opaque, voice anginose, larynx a little tender, respiration a little accelerated. *Tenth* day: false membrane extending; deglutition causes insupportable anguish. *Eleventh* day: very fœtid breath; croupal voice; deglutition impossible. *Twelfth* day: delirium and death.

Necroscopy.—Cervical glands enlarged to thrice their size and inflamed; false membrane upon the pharynx, the uvula, the soft palate, the epiglottis, and larynx: œsophagus healthy; mucous membrane of stomach and small intestine thickened and softened, and elevated by a kind of white granulations, miliary in the neighbourhood of the duodenum, then proportionately larger as the cæcum was nearer; Peyer's patches more or less red and thickened in the ileum, their thickening being due to swelling of the mucous membrane and subjacent cellular tissue; mesenteric glands large, of an amaranth red, especially near the cæcum, where they were softened; spleen thrice its natural volume.

"As to the symptoms peculiar to typhoid fever, if they were little marked, they announced, nevertheless, from their commencement, that the seat of the disease was in the abdomen." (Louis, Obs. xx. p. 187.)

Erysipelas is not infrequently associated with Enteric Fever. Out of 199 cases of Enteric Fever, observed by Louis, Chomel, and Jenner, erysipelas was noticed in twenty. The following is given by Forget as a case of Enteric Fever. We would rather regard it as a case of erysipelas and phlebitis.

Case 11.—A strong man, aged 38, was under treatment in the surgical wards for erysipelas of the left hand, and on a certain day, when the inflammation was in process of resolution, he was seized, without known cause, with shivering, followed by heat, headache, vertigo, nausea, thirst, diarrhœa, and considerable prostration. He was transferred the same evening to the medical wards; expression stupid, sub-icteric tinge, abdomen tympanitic, gurgling, tenderness in right iliac fossa, *Second* day: same state; five liquid stools. *Third* day: pulse 100; six liquid stools. *Fourth* day: same state; diarrhœa; trembling of hands. The patient had been bled on the first day, and to-day one of the punctures is found gaping and exuding a puriform fluid, and the forearm and arm invaded by an inflammatory œdematous swelling very painful on pressure. *Fifth* day: pulse 120; prostration and stupor increasing; several liquid stools; cough; disseminated râles; sub-delirium, and death the same evening.

Necroscopy.—Jaundiced tinge of skin, right arm considerably swollen; pus exudes on pressure from the gaping wound in the vein; vein thickened for length of two inches above the wound. *Chest*—lungs healthy, except a little posterior engorgement. *Abdomen*—alimentary canal healthy to within two feet of the ileo-cæcal valve; Peyer's glands are met with reticulated and swollen; in the intervals a slight psorentery; nearer the valve, and upon it, several patches are in the

same state, but redder, more swollen, evidently inflamed, as were the surrounding parts of the intestine; mesentery contained glands swollen and reddish; spleen very large and friable, and no trace of purulent absorption anywhere.

"Voila, certainement, une entérite folliculeuse bien constatée, au cinquième jour." (Forget, Obs. xi. p. 119.) We confess that we cannot see more than the participation of delicate cellular organs—the solitary and agminated glands, the mesenteric glands and the spleen—in a general febrile condition. Had Peyer's patches been found in an ulcerated condition, the erysipelas, which is clearly the primary disease in this case, would probably have been considered to be a secondary complication of latent Enteric Fever.

The following case shows such implication of the solitary and agminated glands in a general inflammatory condition, as is very common in acute disease.

Case 12.—Mary W. aged 40, came under my care for erysipelas of the head and face, August 12, 1865. She had continued pyrexia and muttering delirium. Pulse 116 to 136, the urine was often retained, and the bowels were confined; tongue dry and brown; evacuations sometimes passed involuntarily; urine contained a little albumen; the stools were solid and natural; she died on the *tenth* day after admission. *Head*—brain healthy, but the vessels congested; two ounces of serum in the ventricles. *Chest*—lungs congested and carnified below and behind; healthy in front; heart normal. *Abdomen*—stomach, save a little finely dotted patch of ecchymosis, duodenum, and jejunum, healthy. Lower portion of the ileum and commencement of the large intestine injected. Peyer's glands in the last three feet of the ileum a little swollen and prominent; the intervening mucous membrane strewn with enlarged solitary glands the size of hemp-seeds, giving to the finger, as it passed over the inflamed membrane, a granular sensation. The mucous membrane of the transverse colon, corresponding to one of the longitudinal bands, was highly inflamed. Some Peyer's glands, higher up in the intestine, were stained with sulphide of iron, and were dotted with black. Here and there the contiguous mucous membrane was also stained black. She had taken perchloride of iron. The colon contained solid natural fæces. Spleen weighed five ounces, and both it and the mesenteric glands were natural in size, colour, and consistence. Kidneys and pancreas congested. Liver weighed two pounds fourteen ounces; it was pale, soft, and greasy; bile pale yellow.

Erysipelatous œdema of the glottis has occasionally caused death in Enteric Fever. Several cases are recorded by Jenner and Trousseau.

Case 13.—*Myelitis.*—"A delicate woman, aged 32, was seized at the catamenial period with sharp pains in the loins, the sides, and lower extremities. Menstruation continued the usual time, but the pains persisted and increased. *Fifteenth* day: dorsal decubitus, headache, prostration; face expressive of pain; moans and cries; the least movement is painful; the patient cannot be made to sit for the examination

of the spine, which is the seat of sharp pains in its whole extent; the joints are equally painful; the muscles and skin are everywhere extremely sensitive; prickling sensations in the hands and soles of the feet; she cannot stand; skin hot; pulse 100, small and hard; tongue furred; mouth clammy; anorexia; thirst; abdomen, like all the rest of the surface, tender; one stool a day. We diagnose a cerebro-spinal affection. *Seventeenth* day: acute pains; the patient says she cannot feel her limbs, but when they are touched she complains of extreme sensitiveness; spine painful on pressure throughout its whole extent; bowels confined. *Eighteenth* day: general pains; the patient cannot move. *Nineteenth* day: delirium, plaints; acute general pains; stools and urine involuntary; skin hot, sweating; pulse 112, large and supple. *Twentieth* day: same state; diaphoresis, sudamina, vomitings, and numerous stools. *Twenty-second* day: vomiting ceased; numerous involuntary stools; abdominal gurgling; immobility; acute pains provoked by movement; pulse 120. *Twenty-third* day: continued delirium; involuntary stools. *Twenty-fourth* day: the patient is pale, almost pulseless, and bathed in cold sweats; died this day."

Necroscopy twenty-two hours after death.—*Head*—meninges slightly injected; brain of natural appearance and consistency; a little serum in the ventricles; coverings of the cord much injected; a great quantity of serum flowed from the spinal canal. The *spinal marrow* "est ramollie dans une grande étendue, sans changement de couleur; ce phénomène est évidemment cadavérique." *Abdomen*—stomach inflamed in patches. Small intestines present only some vascular ramifications to within two feet from the cæcum; then granulations (*psorentérie*) appear, then reticulated Peyer's patches, others ulcerated very numerous, some appear to be cicatrizing, and some already cicatrized; in the large intestine some isolated follicles appear to be affected; mesenteric glands engorged; spleen and liver present nothing of importance; the bladder contains turbid fœtid urine, and its mucous membrane is strongly injected and dotted. (Obs. xxviii. p. 286.—Forget.)

M. Forget had headed this case "Entérite folliculeuse latente, prise pour une affection cérébro-spinale. Forme, rheumatismale." And after he has detailed the symptoms and post-mortem appearances transcribed above, he asks, "Where is the practitioner who would not have been deceived, as we have been, by appearances so fallacious? How recognise a case of follicular enteritis under such a predominance of sensitive nervous phenomena?" Only by regarding lesions of Peyer's patches so long and so exclusively that no other pathological condition can be conceived possible, we answer.

M. Forget attributes the softening of the cord to post-mortem changes, but the cord is not softer than the circumferential parts of the brain; it is equally well protected from maceration by its vascular coverings, and, from its situation in the axis of the body, it is less liable to post-mortem changes than the brain itself, which, in this case, is described "de consistance et d'aspect naturels." We know of no symptoms, or post-mortem appearances, which could more positively

assure us of the existence of inflammatory softening of the cord, than those which the eminent Strasbourg professor here places before us.

Phthisis.—In order to illustrate the similarity between the symptoms of tubercular ulceration of the intestines, associated with pulmonary tuberculosis, and those of Enteric Fever, I will here translate two cases from M. Louis's work on typhoid fever, and which this eminent author gives as examples, the one of ordinary enteric fever, accompanied by delirium, and the other of latent enteric fever, but which, with due deference to so great an authority on both phthisis and typhoid fever, we feel bound, from our own observations, to regard as cases of tubercular disease. We might have adduced instances in which the lungs were more extensively diseased, from our own practice, but we prefer to place before the reader the description and conclusions of some other author. The reader will form his own opinion on the nature of these two cases, bearing in mind the frequent coexistence of tubercular disease of Peyer's and the solitary glands in pulmonary phthisis, and the difficulty which exists in distinguishing acute tubercular inflammation and ulceration of the glands of the ileum, from the corresponding lesions of ordinary enteric fever.

Case 14.—A young woman, aged 17, "d'un embonpoint médiocre," had had cough for four weeks, and in consequence of afflicting intelligence suffered headache, loss of appetite and strength, thirst, increased heat, constipation; the headache was relieved by leeches, the other symptoms continued to the *eighth* day. She took some ipecacuanha, which produced bilious vomiting and purging, with pains in the hypogastrium; cough a little increased. *Ninth* day: sleepy; slight delirium at night; belly everywhere tender on pressure, supple; no tympanites; one stool; pulse 105; intense dry heat; some lenticular rose spots on the back and anterior and lateral parts of the chest; cough moderately frequent; oppression of the chest, mucous râles; in the evening tranquil but profound delirium. *Tenth* day: partly recovered consciousness; tongue red and moist; abdomen tympanitic, a little tender on pressure; heat considerable; startings continue. *Thirteenth* day: pulse weak; mucous sputa, some streaked with blood; a little crepitation at base of right lung behind; continuation of the involuntary movements and meteorism; continued drowsiness during the day, and delirium at night. *Fourteenth* day: meteorism decreased, three or four involuntary stools; crepitant râles heard over the sides of the chest. *Fifteenth* to *nineteenth* day: profound drowsiness and delirium at night; on the evening of the *nineteenth* day respirations much embarrassed, 60. *Twentieth* day: delirium and ineffectual efforts to put the arms out of bed; death.

Necroscopy.—*Head*—brain and meninges apparently normal, only moderately injected. *Chest*—lungs free, filling the cavity of the chest, of a tender rose-colour in front, a little engorged behind for some extent, strewn internally with a great number of grey semi-transparent granulations; bronchi injected, their last divisions covered with a puriform secretion. *Abdomen*—mucous membrane of the small intestine

very soft, of an obscure red near the cæcum; Peyer's patches were only visible in the ileum; those nearest the jejunum were pale and obscure, the rest red and successively more developed, larger, and more thickened, in proportion as they were nearer the ileo-cæcal valve; those in the last foot of the ileum were ulcerated, their mucous membrane more or less destroyed, and in some the muscular fibres, which were red and thickened, were discovered. The non-ulcerated plates were about a line in thickness. Between Peyer's patches were others much smaller, irregular, and otherwise resembling them, and some yellow, miliary granulations. The last two inches of the mucous membrane were entirely destroyed around nearly the whole of its circumference, and the submucous cellular tissue was more or less red and thickened. Large intestine: mucous membrane thickened and very soft, and presented a considerable number of greyish, lenticular spots, marked with a black point in their centre. All the mesenteric glands were red and livid, and those near the cæcum very large and soft. The mesocolic glands were in the same condition. The spleen was nearly double its volume. (Louis: Obs. xxxiv. p. 25, vol. ii.)

It is strange that Louis, of all other observers, should consider the foregoing to be a case of typhoid fever, when the history and anatomical characters are so plainly those of acute tuberculosis. The nature of the other case is still more apparent.

Case 15—A spare man, aged 25, having short breath from the age of ten years, is taken with the following symptoms:—Disgust of food, thirst, cough, shiverings followed by heat. These symptoms continued, with constipation, until the *twenty-first* day, when he was admitted into the hospital of La Charité. He presented the same symptoms with slight oppression at the epigastrium; constipation still; heat of skin a little exalted, general moisture; pulse large and moderately full; cough infrequent; some mucous expectoration; natural respiratory murmur; moderate weakness. *Twenty-fifth* day: some lenticular rose spots on the abdomen and chest; pulse 86. Up to the *thirty-seventh* day the patient continued stationary, then for the first time he had spontaneous diarrhœa, and grew paler and weaker. *Thirty-eighth* day: a sudden and violent pain in right testicle and corresponding part of hypogastrium, accompanied by a little shivering. The pain came on again in the night, and his slender body was covered with large drops of sweat; he had neither nausea, nor vomiting, nor tympanites; pulse 104. *Thirty-ninth* day: copious diarrhœa; several vomitings of green bile; sweats and pain continued all day These symptoms continued up to the *forty-fifth* day, when there was great abdominal pain and vomiting. He died this day.

Necroscopy.—Considerable emaciation. *Head*—slight sub-arachnoid effusion. *Chest*—the summit of the left lung presented some cellular adhesions, was a little hard and unequal, and offered for the depth of two inches a considerable number of grey, semi-transparent granulations, in the midst of which a tuberculous excavation was found the

size of a nut, partly empty, and communicating with the bronchi. Below, the pulmonary tissue was in the normal condition. The right lung was in the same condition. *Abdomen*—General peritonitis from perforation of the small intestine about five inches from the cæcum; red patches, due to injection of the peritoneum upon the external surface of the small intestine; internally, this part of the bowel presented, at about twenty-four inches from the cæcum, a transverse ulceration about ¾ths of an inch in extent, opposite the mesentery, having the attenuated muscular coat for its base, and the edges were not very prominent, and slightly greyish. Six similar ulcerations existed in the last six inches of the ileum, and in the centre of the first of them the perforation, measuring about a fourth of an inch in diameter, was found. The edges of this ulcer were very thin, and partly formed by the peritoneum alone.

The mesenteric glands were a little red, and three or four times their natural volume, and had only half their usual consistence; liver a little pale and soft; spleen twice its natural volume, a little pale and soft.

"The thirst, anorexia, pains in the head, and the shiverings clearly indicate the commencement of the illness in this case. It was only after three weeks that the pains in the belly were experienced. Diarrhœa came on as late as the thirty-seventh day. The ulcerations of the intestine being the most profound and without doubt the oldest lesions observed, to these ought to be attributed, in great part at least, the febrile symptoms present at the commencement. It is requisite, however, to remark that the tuberculous affection commenced, according to all appearance, with the principal disease, yet as the ulcerations of the small intestine had the characters of those which occur in the course of the typhoid affection, and as the state of the mesenteric glands* could only be referred to that condition, this disease has evidently had the greatest share in producing the symptoms and lesions observed, and we can only place this case in the chapter upon the latent typhoid affection." (Louis, Obs. xliii. p. 232, et seq.)

Endemic Intermittent and Remittent Fevers.—One of the most general facts observed in reference to Enteric Fever, is the frequent occurrence of intermittence in the pyrexial condition. The commissioners appointed to investigate the French epidemics of Enteric Fever, "call attention to the fact that a more or less pernicious intermittent, or at least remittent character, was manifested under a great variety of circumstances." (De Claubry, Mem. de l'Acad. de Méd. tom xiv. p. 71.) "A great number of cases of typhoid fever, presented either at the commencement of the disease, transient symptoms of simple intermittent fever, or during its further progress, intermittent

* Louis appears to regard a vascular, swollen, and softened condition of the mesenteric glands as being inconsistent with the existence of tubercular disease. We have frequently seen the mesenteric glands purple, soft, and swollen in cases of advanced phthisis in which both lungs and intestinal glands have been affected. (See Diagnosis.)

or at least remittent phenomena, which rendered the employment of quinine necessary." (Ibid. p. 11.) M. Torusseau (Clinique Médicale) records cases to show that "Enteric Fever may simulate at first intermittent fever, and reciprocally, an intermittent fever may assume at the commencement the characters of typhoid fever" (p. 247, 2d edition). "It is especially in countries where marsh intermittent fevers are endemic, and with individuals who have recently left their own country, that we see Enteric Fever assume at its commencement an intermittent type" (p. 250).

Intermittent fever is, in the present day, nearly extinct in England. Its last strongholds are to be found in the north part of Kent. There, about the Isle of Sheppy, and on the marshy banks of the Swale, it still lingers. At Milton, for example, ague is still common in the autumn. "The drinking water is obtained from wells, and the general sanitary condition, as regards drainage and the non-removal of nuisances, is unsatisfactory, and there has been a considerable amount of typhoid fever at times, and scarlatina in a severe form was prevalent at the time of the inspection." (Rep. by Dr. G. Whitley, as to quantity of ague now prevailing in England. Sixth Rep. Privy Council, 1863, p. 432.)

At Holbeach and Long Sutton, Ague and Enteric Fever were both prevalent. The drainage of these places is bad, and the water supply bad, being from pits (p. 441). "Very nearly all the medical men who had had opportunities of forming an opinion concerning the co-existence of ague and typhoid fever in the same districts, were of opinion that the local conditions which produce the former are favourable to the development of the latter. Thus, Mr. Keddell, with forty years' experience in Sheppy, believed that when ague, from certain conditions of surface, is rife in summer, bilious, remittent, and typhoid fevers prevail in autumn." (Ibid. p. 452.)

My friend, Mr. Charles Mayo, informs me, from extensive personal observation, that the "camp fever" of the army of the Potomac was generally recognised as a "typho-malarious fever," in which the symptoms of typhoid fever, diarrhœa, rose rash, &c. were associated with those of intermittent fever. The typhoid symptoms occasionally predominated, and post-mortem examination revealed lesions of Peyer's glands.

It is evident from the foregoing observation that an investigation into the nature of Enteric Fever would be very incomplete without a brief consideration of the symptoms and morbid anatomy of the severer forms of intermittent fever. The Walcheren fever offers itself as a standard of comparison. Dr. Davis* has given a very clear and minute description of this disease. "The Walcheren fever," he says, "assumed the quotidian, tertian, double-tertian, and even remitting type. It did not uniformly declare itself with the same type, being one while continued, then remittent or intermittent, and changing its type again from these to the continued character. I believe the

* View of the Fever of Walcheren and its consequences, by J. B. Davis, M.D. 8vo. Lond. 1810.

Walcheren fever in many instances would have ceased but for the derangement it had occasioned in the abdominal viscera, becoming in some measure a secondary disease" (p. 12, et seq). The *premonitory symptoms* were weakness, nausea, headache, universal langour, dejection of spirits, always combined with a vitiated state, suppression, or diminution of the intestinal and biliary secretions.

After the paroxysm, headache, confused intellect for two or three days, ending in coma and torpor. At other times continued pyrexia, whiteness of the tongue, distension and uneasiness of the epigastric region, and anorexia. Then the bowels became painful, and there was diarrhœa, discharge of mucus, or much blood intermingled with fæces, &c. &c. These symptoms would be obscured by the paroxysm, to reappear after it was over (p. 18). "All the patients with the quartan type under my care were very prone to diarrhœa and dysentery, thirst, pyrexia, emaciation, daily exacerbations of hectic, local pains, and general irritation, constituting an unmanageable disease which wore away the patient's strength, and utterly exhausted him" (p. 17). Delirium was seldom formidable; epistaxis frequently occurred. Hectic was almost uniformly the character of the pyrexia. Grey, clay-coloured watery stools, and rapid marasmus, were common in cases tending to a fatal termination.

Such were the symptoms of "the continued fever or long continued paroxysm," when the order of the periods became so completely over-turned that it was difficult to bring the fever to its proper type again (p. 21).

If we now turn to the morbid anatomy of the disease, we shall find positive evidence of lesion of the solitary and agminate glands of the small intestines, in at least six of the cases recorded by Dr. Davis. Usually both the small and large intestine were involved in the disease, and its ravages greatest in the latter. Thus, in case 29, we have a description of the post-mortem appearances of dysentery implicating the small intestine:—Colon ulcerated throughout its whole extent. Rectum much ulcerated and had sloughed near its termination. Jejunum and ileum "interspersed with black spots internally; the intervening spaces red, and raised up into little protuberances, resembling granulations of flesh, not unlike a cock's comb." Liver large, black, and soft. Spleen soft, of enormous size. Mesenteric glands enlarged (p. 173).

In case 32 the large and small intestines appear to have been pretty equally affected. "The small intestines were of a deep purple colour, and interspersed on their inner side with tubercles and small ulcers, resembling chancres. The colon and rectum had numerous tubercles and ulcerations." Spleen weighed four pounds, and was uniformly soft throughout. Mesenteric glands enlarged (p. 175).

In case 34 the lesions were more apparent in the small than in the large intestine. The convolutions of the small intestines were united together by condensed coagulable lymph. They were of a reddish colour, and interspersed with small red eminences on their

inner surface. The coats of the colon were thickened. Liver large and black. Spleen firm and dark, weighed four pounds.

The particular characters of the intestinal lesions are thus clearly described by Dr. Davis. The ileum and jejunum were frequently interspersed with "tubercles inflamed and ulcerated in different parts. Here and there small eminences of the size of a pin's head, or round bodies with an ulcer at the point, or little ragged ulcers, excavated in the middle, resembling chancres, or one large, or a succession of small ulcers spreading wide upon, and deep into, the coats of the intestines. Colour of these tubercles various, consistence firm. While their points were yellow their edges were hard, and their bases almost black, like a lump of decayed flesh. They did not come fairly to suppuration, but appeared gradually to crumble away and degenerate into a scabrous ulcer. These bodies had their origin beneath the villous coat of the intestine" (p. 191).

From the above description we may infer that the morbid condition of the solid and agminate glands of the intestine in these fatal cases of intermittent fever is identical with that which is assumed to be characteristic of Enteric Fever. We have already seen that both forms of fever are developed amidst the same conditions, and we therefore unhesitatingly conclude that Enteric Fever is often a part of Intermittent fever, and the converse.

Dysentery.—After the foregoing observations it may appear superfluous to call special attention to the relation between Dysentery and Enteric Fever. But the connexion between these two diseases is too important to receive only a cursory notice. Even in reference to Enteric Fever alone, it is important to observe that the ulceration sometimes spreads to the large intestine, when the lesions of the small intestine are in process of reparation. The following isolated case recorded by Forget, may be briefly mentioned to show how the enteric disease may be prolonged by subsequent lesion of the large intestine.

Case 16.—A patient was laid up with the usual symptoms of Enteric Fever for a month, then, after a few days' intermission, profuse dysenteric diarrhœa, tenesmus, and colic pains set in, and after continuing for about twenty days killed the patient. In the last two feet of the ileum, "numerous white shining spots, of variable extent, smaller than the ulcerated Peyer's patches, and evidently cicatrices, were found. The great intestine was profoundly altered in all its extent from the ileo-cæcal valve to the anus; it was brown, black, hypertrophied, vegetant, and softened, presenting ulcerations of various depth." (Forget, Obs. xlii. p. 351.)

Rokitansky describes "the typhous process in the mucous membrane of the small intestine," as distinct from "the dysenteric process" observed in the large intestine. But this distinction is purely artificial. In the following well-marked case of Enteric Fever which lately died under my care, the large intestine was the more extensively ulcerated, and the ulcers in both small and large intestine were indistinguishable from the so-called "dysenteric ulcers."

Case 17.—Catherine M. aged 23, residing at Stanmore, near London, was taken ill this autumn with headache, much shivering, pain in the back, and diarrhœa. Fever and diarrhœa continued, rose spots appeared on the abdomen from the *tenth* to the *twenty-second* day. Diarrhœa persisted and there was much hectic. On the *twenty-fourth* day there was marked abdominal tenderness. The diarrhœa continued unchecked, and she died on the *twenty-seventh* day.

Necroscopy.—Chest—lungs congested, friable at apices, weighed thirty-three ounces. *Abdomen*—liver enlarged, weighed three pounds five ounces, soft, greasy, and pale. Gall-bladder full of pale, thin, ochre-coloured bile. Stomach, duodenum, jejunum, and upper portion of ileum healthy; last two feet of ileum presented sixteen ulcerations of Peyer's glands, varying from minute vascular abrasions to the three-eighths of an inch in diameter. Four of these pale depressed ulcers were situated immediately above the ileo-cæcal valve, and were evidently in process of contraction and cicatrization. In the large intestine there were twenty-seven ulcers, twenty of which were in the cæcum; several were situated immediately beneath the ileo-cæcal valve, and one of these was as large as a shilling, and deeply excavated the muscular fibres; another, the size of a sixpence, was placed at the bottom of the cæcal pouch, and it lay upon the peritoneum, which presented externally a corresponding patch of opacity with vascular ramifications. Seven other ulcers occurred at intervals in the ascending and transverse colon, the last one occurring at a distance of two feet from the ileo-cæcal valve. All these ulcers were pale, with ashy or smooth bases lying upon the muscular fibres; their edges were not elevated, and often perpendicular. The solitary glands of the large intestine were enlarged, the central parts of many were eroded and in a state of incipient ulceration. The mesenteric and mesocolic glands were purple, much enlarged, and soft. The spleen weighed six-and-a-half ounces, and was of normal colour and consistence. Kidneys, pancreas, and the other organs healthy.

The day after this young woman died, a patient, in the same ward, under the care of my colleague, Dr. Murchison, also died, and, as the case illustrates very well how extensively the large intestine may be ulcerated in Enteric Fever, I have availed myself of Dr. Murchison's kindness in allowing me to make my observations of the case, and briefly detail them here.

Case 18.—Eliza H. aged 26, was admitted on the *tenth* day of her illness with fully-developed Enteric Fever. She was taken ill with headache, heats and chills, and diarrhœa, and these symptoms continued to the time of her admission. Rose spots appeared on the abdomen from the *tenth* to the *eighteenth* day. The bowels continued very loose, and the stools were of a light yellow colour. Medicines failed to restrain the diarrhœa, the abdomen became distended and tender, and the patient died exhausted on the *twenty-seventh* day of her illness.

Necroscopy.—Chest—lungs healthy, with only a little hypostatic

congestion. Heart contained firm fibrinous clots in all its cavities. *Abdomen*—stomach, duodenum, jejunum, and upper portion of ileum perfectly healthy. In the last two feet of the ileum there were a dozen pale non-elevated ulcerations of Peyer's glands; six of them were in the immediate neighbourhood of the ileo-cæcal valve, and the largest did not exceed three-eighths of an inch in diameter. All were evidently in process of healing. The large intestine was in a state of ragged ulceration from the under surface of the ileo-cæcal valve to within an inch of the rectum. In the transverse and descending colon there were two rows of ulcers, each about a foot long; these ulcers were very deeply excavated, and for the most part confluent, or only separated by narrow bands of hypertrophied mucous membrane. Each ulcer, or confluent patch, was about an inch wide. The edges were two or three lines thick, irregular and very vascular, and often black; the surface of the ulcer was chiefly formed of ashy sloughs of areolar tissue, or disintegrated muscular fibres. In the interval between these rows of ragged ulcers, were a great many circular ulcers, and swollen solitary glands advancing to this condition. Nearer the cæcum and rectum the ulcers were fewer and more discrete. The mesocolic glands were greatly enlarged, purple, and soft. The spleen weighed eight and a half ounces, and was pulpy. The liver was very soft and greasy; it weighed forty-four and a half ounces. The gall-bladder contained half an ounce of pale yellow watery bile, which did not affect turmeric paper, but changed blue litmus to red. The other organs were quite healthy.

In the following case of Enteric Fever and pneumonia, the intestinal lesion was almost entirely confined to the colon:—

Case 19.—Phœbe Poole, aged 14, was admitted into the London Fever Hospital on the 8th of September, 1865, on the *fourteenth* day of her illness. She had had cough, quick breathing, and diarrhœa, accompanied by high fever. At this date the pulse was 150, tongue dry, brown, and cracked, skin pungently hot, respirations 48, cough, dulness with crepitation and bronchophony over the lower lobe of the right lung behind; there was retention of urine, the abdomen was tympanitic and tender, there were two rose spots upon its surface, and the bowels were very loose. The pulmonary and enteric inflammation progressed, tubular breathing was heard over almost this whole of the right side of the chest, and the bowels continued very loose. A few fresh rose spots appeared up to the *nineteenth* day. On the *twenty-ninth* day the respirations were 60, short and snatchy, the pulse 160, and the diarrhœa profuse. On the *thirty-fifth* day she died.

Autopsy.—Chest—right lung completely solid and firm, grey and gangrenous. Left lung a little engorged. Heart healthy. *Abdomen*—the last Peyer's patch near the ileo-cæcal valve had two minute ulcerations, but the rest of the gland, and all the other agminated and solitary glands, were perfectly healthy. The colic side of the cæcum, and the first five inches of the ascending colon, were in a state of ragged

ulceration—long, clean, transverse ulcers, laying bare and dissecting the muscular fibres, were repeatedly confluent in this part of the bowel, and were interspersed with islands of soft, greatly-swollen, mucous membrane. Lower down, were ulcerated solitary glands, and there were six more in the sigmoid flexure. The solitary glands and mucous membrane of the rest of the large intestine were generally healthy. The mesenteric glands corresponding to the small intestine were quite healthy; the mesocolic glands in the neighbourhood of the cæcum were purple, soft, and much enlarged. The rest of the viscera appeared healthy. The spleen was of natural size.

Such cases as the foregoing, afford typical examples of acute dysenteric ulceration, and we may question whether the distinction between Dysentery and Enteric Fever is not somewhat artificial.

Cholera.—"In the delta of the Ganges, the Nile, and the Mississippi the three forms of disease called cholera, plague, and yellow fever, are constantly seen preceding, accompanying, and following intermittent fever, and constitute there the reigning endemic diseases; and one is forced to recognise a very great analogy, not to say an identity, of origin between the marsh fever and the three great scourges above mentioned." (Traité des Fièvres intermittentes, rèmittentes, et continues, par J. C. M. Boudin, p. 161.) A protracted attack of cholera bears a close resemblance to Enteric Fever; the intestinal lesions of the two diseases, moreover, are indistinguishable from each other. "The most frequent of all the abnormal conditions of the mucous membrane of the intestines was prominence of the intestinal glands, both aggregate and solitary, but especially the latter. This condition, the psorentérie of some French writers, was found in about two-thirds of the eighty-nine fatal cases examined." (W. T. Gairdner, M.D. Month. Journ. Med. Science, 1849.) M. Pirogoff examined 500 fatal cases of cholera. He observed in the earlier periods of the disease, "thickening and swelling of the mucous membrane most often accompanied by swelling of Peyer's and the solitary glands, as well as swelling of the mesenteric glands. In the typhoid period, ulceration of these glands." (Anatomie Pathologique du Cholera Morbus. Folio, St. Petersburg, 1849.)

Scurvy is sometimes accompanied by ulceration of the solitary and agminate glands, with all the symptoms of Enteric Fever. An outbreak of scurvy occurred in the Milbank Penitentiary, in London, in the years 1822–23. An account of it was published by P. M. Latham, M.D. (8vo. Lond. 1825.) "In addition to the ordinary symptoms of scurvy—purpura hæmorrhagica, spongy and bleeding gums, &c.—there was every degree and species of flux ever seen or described. There were cases which corresponded with the descriptions of the Indian cholera, and there were some which corresponded with the common autumnal cholera of this country, except that they were accompanied by intractable diarrhœa. There was every kind and degree of dysentery" (p. 32–33). In some cases the abdomen was soft and natural; in others tympanitic. Post-mortem examinations

revealed lesions of the intestines, which, from the descriptions at pp. 46–49, are clearly to be attributed to swelling and ulceration, even to perforation, of the solitary and agminated glands.

Varieties.—After the foregoing review of the associated pathology of Enteric Fever, can we adopt the dogma of Chomel: "Quand nous trouverons dans les auteurs, soit anciens, soit modernes, des observations, de maladies aigues a la suit desquelles, on aura rencontre des ulcéres a la fin de l'intestine grêle, nous aurons le droit de les considérer comme des cas d'affection typhoïde" (Fièvre Typhoïde p. 113.)? Or, going to the other extreme, shall we deny the existence of Enteric Fever as a specific disease, and regard the intestinal lesions merely as the result of an accidental but severe local complication which may arise in any general febrile condition of the body? If we accept the first proposition, we must include Tuberculosis under Enteric Fever. If we adopt the second, we may, with almost equal reason, deny the existence of Scarlatina as a distinct disease. We can only avoid the dilemma by admitting that the enteric disease, and all its attendant phenomena, may occasionally become a part of some other more general inflammatory condition, and then, I think, it can hardly be denied that in other cases the disease is due to some poison or poisons introduced from without, in the elimination of which, the digestive organs especially are deranged. In order to include all the phenomena of Enteric Fever, I find it necessary to divide it into these three varieties: (1) Simple Inflammatory Enteric Fever; (2) Contagious Enteric Fever; (3) Paludal Enteric Fever.

It may seem paradoxical and unphilosophical to include under one kind contagious and non-contagious diseases; but since the question of contagion is still an open one with many, and neither symptoms nor anatomical lesions mark a distinction, we must be content thus to classify the disease for the present.

1. *Simple Inflammatory Enteric Fever.*—This variety is non-contagious, due to no specific cause, and may arise in any inflammatory condition of the body, such as accompanies pneumonia, erysipelas, pyæmia, &c. The common enteritis, which constitutes autumnal diarrhœa, if protracted, often lapses into this variety of Enteric Fever. Cases 6, 7, 11, 19, &c. furnish examples of this variety. The recognition of the intercurrence of enteric inflammation, with ulceration of the glands of the ileum, in acute disease generally, is of very great importance; for of all the organs of the body, these delicate glands, from their situation within the thin and vascular intestinal wall, are less capable than similarly constituted parts elsewhere situated, of enduring prolonged inflammation, without risk of fatal accidents; and at any time the intestinal lesion may become much the gravest part of the more general disorder. The frequency with which the intestinal glands become implicated in acute disease is probably due to their exposed situation, their delicate corpuscular structure, their great vascularity, and the arrangement of their bloodvessels.

A well-developed healthy lad, aged 15, fell from a horse; the skull was fractured, and the corresponding surface of the brain lacerated; febrile action followed, and he died on the third day. Before the body was cold I examined the small intestine. In the last nine inches of the ileum I found the solitary glands swollen, and of a delicate greyish-pink colour, and semi-transparent appearance, forming rounded elevations of the mucous membrane, the size of hemp-seeds. (Psorentery.) The mesenteric glands were a little increased in vascularity and size. There was no trace of disease in any part of the body. Here we recognise a condition of the solitary glands, which, under the continuance of the general febrile action, *might* have passed into the worst form of "typhoid ulceration."

"But surely," it will be said, "we can distinguish the true typhoid ulceration from any other at a glance; moreover, the typhoid ulcer is characterised by the deposit of a distinct morbid material—a specific *typhous cell*." Having already shown that the inflammatory swelling is due, not to the deposit of a specific morbid matter within the glands, but to the rapid growth of their normal corpuscular constituents under the influence of undue vascular excitement, we fail to recognise any character by which one form of inflammatory action in Peyer's glands can be distinguished from any other. Ultimately, we shall have little or no difficulty in distinguishing a tubercular ulcer from any other; but between the lesions assumed to be characteristic of Enteric Fever and those arising from ordinary inflammation, which, of course, may affect the intestinal glands in common with every other part and organ of the body, there is, I conceive, no distinction. As a result of common inflammatory action in the glands, we may find Peyer's glands swollen into cock's-comb or fungus-like elevations, and excavated into ragged ulcers, with red everted edges, or occupied by sloughy cores. (See case 8.) In a well-marked case of Enteric Fever, in which the diarrhœa, rose spots, and abdominal pain and swelling call attention to the abdominal lesion, we may, on the other hand, find, as in a case which I examined two days ago, a dozen angry-looking ulcers in the last foot of the ileum, varying in diameter from two lines to three-fourths of an inch, and exposing the red-streaked muscular fibres, each ulcer sharply cut, and the irregular margins *not* raised above the general level of the intervening dark red mucous membrane. Higher up were seen glands level with the inflamed mucous membrane, and presenting sloughy erosions, like an aphthous ulcer of the mouth.

2. *Contagious Enteric Fever.*—Of this variety I can say but little. I am not *sure* that I have seen it; but that it exists, appears to be an indisputable fact. Eight of the sixty-eight patients, referred to below, came from houses in which other residents were affected with the fever. The disease may have been propagated by contagion in some of these cases, but in two instances, in each of which three members of the same family were affected, I found from personal observation, that an endemic cause existed in impure drinking water.

See also cases 4 and 5, and the observations upon "Contagion." The associations of this variety appear, as I have already pointed out, to be, with scarlatina and the allied affections, diphtheria and croup. Exudations upon the faucial and laryngeal mucous membrane appear to be frequent in this variety, and the course of the disease more rapid than in the third variety.

3. *Paludal Enteric Fever.*—This we believe to be the common form of the disease. It arises from putrescent animal and vegetable substances. It is non-contagious, and its course is usually slow. Case 2 may be taken to illustrate this variety of the disease.

In thus unreservedly recognising the connexion which, I cannot doubt, exists between Intermittent and Enteric Fever, it may appear to some that I transgress the facts which have been adduced to illustrate this view; but I feel sure that justice has not been done to the numerous observations which abound in medical literature, and which, if collected, would together form irresistible evidence of the direct connexion between these two diseases. In the low-lying districts on the banks of the Thames, within and about the metropolis where ague was formerly so rife, Enteric Fever prevails continuously, becoming very abundant in the autumn, while the higher situations are comparatively free from it. Of sixty-eight cases of well-developed Enteric Fever which have come under my care during the present autumn, 1865, fourteen came from the districts of Stanmore, Chelsea, Lambeth, Southwark, Stepney, Hackney, Bethnal Green; thirteen from the lowest part of the parish of St. Luke alone, where cesspools and pumps are still in use, and where drainage works are now in progress; twenty-three from the filthiest and most crowded parts of the parishes of St. Clement Danes, Holborn, and St. Giles; and only five from the more elevated localities of Soho and Marylebone, Islington, Holloway, &c. The remainder resided in Maidstone, Croydon, Mitcham, Edmonton, and various other country districts near London.

We find Enteric Fever remarkably prevalent in the spreading outskirts of the suburbs, where new houses and streets are constantly springing up beyond the limits of the drainage works.

We acknowledge as modifications of the same disease, that intermittent form to which, when London had its cesspools and pumps, and retained all its filth within its undrained area, James I. fell a victim, and that continued modification which still lingers in a subdued form in the same locality, and to which a good Prince has succumbed in our own generation.

Distribution.—Enteric Fever prevails in every inhabited part of the world. No situation is secure from it. In the report of the epidemics which have occurred in France from 1841 to 1846, De Claubry (Mem. de l'Academie de Méd. tom. xiv.) observes: "The situation of the twenty-eight departments, which have been the frequent theatre of destructive epidemics of typhoid fever, was such,

that it appeared impossible to conclude that it had any influence whatever in the production of these epidemics" (p. 4). "If one finds typhoid fever on the one hand in villages situated in deep valleys, in narrow gorges; in lowlands, where the water-courses frequently overflow, making the submerged soil, upon which the miserable dwellings are built, extremely damp: one sees it, on the other hand, in villages situated, one upon the most elevated points of a high chain of mountains, and constantly exposed to every wind, and having no unhealthy condition in its neighbourhood; another situated 600 feet above a little flowing stream, commanding an extensive view of perfectly cultivated fields; a third, in a very salubrious position, upon an undulating soil, where the flow of water is perfect" (p. 8).

Enteric Fever, moreover, attacks every class of society indifferently. On one hand, we find it associated with the most abject poverty, damp, filth, overcrowding, and defective ventilation; and, on the other, we witness the disease making havoc amongst the wealthy residents of spacious, dry, well-built houses, isolated, or united to form wide open streets, or elevated terraces.

CAUSES: (*a*) *Predisposing.*—Of the causes which predispose to Enteric Fever, *youth* is usually considered to be one; but young people are not more liable to this than they are to other inflammatory diseases. Dr. Murchison states (page 409), that slightly more than half of the cases of Enteric Fever admitted during ten years into the London Fever Hospital were between fifteen and twenty-five years of age; one-fifth were under fifteen; less than one-seventh above thirty; and only one-sixty-eighth exceeded fifty. Similar statistical results may probably be found in many other acute diseases.

Seasons have a marked influence on the increase and diminution of Enteric Fever. "Out of 106 times in which an exact indication of the epoch when the epidemics of typhoid fever commenced, the reports of the years 1841 to 1846 give the following results:—First yearly quarter, twenty epidemics; second quarter, twenty-one; third quarter, thirty-nine; fourth, thirty-six; or, summer (April to September), sixty; winter (October to March), fifty-six. Seventy epidemics commenced in the four months of August, September, October, and November; while only forty-six commenced in the other eight months of the year, from December to July." (De Claubry, Op. cit. p. 8.)

"In New England Enteric Fever is not infrequently called the autumnal or fall fever." (Bartlett on Fevers, p. 101.)

On examining the accompanying Table (vide Table) of the cases which have occurred at the London Fever Hospital during the last eighteen years, the following facts appear:—*First*, that the greater number of cases occur during the autumn and winter months, and the average of seventeen complete years* shows that more than twice as many cases, or a proportion of 2·1 to 1, occur during these periods, as compared with those happening during the other six months of

* From 1848 to 1864 inclusive.

TABLE *showing the number of cases of* ENTERIC FEVER *treated in the* LONDON FEVER HOSPITAL, *and certain attendant atmospheric conditions, during the last eighteen years. The analytical observations have no reference to* 1865, *which was incompleted when they were made.*

The *first column* gives the number of cases admitted during every month, season, and year. It is partly derived from p. 417 of Dr. Murchison's work, and partly from the London Fever Hospital Reports. The *second column* gives the mean temperature of the air during each month, season, and year. The *third column* shows in like manner the mean degree of moisture contained in the air. The numbers have reference to 100, which is taken to represent the greatest quantity of aqueous vapour which the air can at any temperature retain. The *fourth column* gives the total rainfall in each month, season, and year. The second, third, and fourth columns are from the Registrar-General's Returns, and are due to Mr. James Glaisher, F.R.S.

	1848.				1849.				1850.				1851.				1852.				1853.				1854.				1855.				1856.			
	Cases.	Temperature.	Moisture.	Rain.	Cases.	Temperature.	Moisture.	Rain.	Cases.	Temperature.	Moisture.	Rain.	Cases.	Temperature.	Moisture.	Rain.	Cases.	Temperature.	Moisture.	Rain.	Cases.	Temperature.	Moisture.	Rain.	Cases.	Temperature.	Moisture.	Rain.	Cases.	Temperature.	Moisture.	Rain.	Cases.	Temperature.	Moisture.	Rain.
		°				°				°				°				°				°				°				°				°		
January .	9	34·6	83	1·2	9	40·1	88	1·6	6	33·7	89	1·2	13	42·9	85	2·7	10	42·0	84	3·6	17	42·4	80	2·0	13	39·0	91	1·7	16	34·9	91	1·0	12	39·4	91	2·6
February .	9	43·4	86	2·6	7	43·2	86	2·2	5	44·7	83	1·3	8	40·1	87	1·2	12	40·8	87	0·9	7	33·3	80	0·9	13	39·5	84	1·0	9	29·4	91	1·4	10	42·0	87	1·1
March . .	7	43·8	83	3·1	5	42·5	80	0·5	5	39·9	77	0·3	12	42·6	84	4·1	6	41·3	81	0·2	14	38·5	78	1·5	7	43·8	79	0·4	5	37·9	86	1·5	8	38·7	82	1·1
April . .	4	Mean temp. & hum. of suc. qr. & totl. rain.			3	43·2	86	2·2	7	48·5	79	2·3	8	44·7	82	2·3	7	45·9	75	0·5	5	45·2	77	3·1	6	48·4	77	0·6	8	45·8	78	0·1	8	46·8	74	2·3
May . . .	4	54·3	81	7·3	4	54·0	70	3·9	14	51·3	76	2·4	16	50·9	76	0·8	9	51·5	77	1·9	6	52·0	74	1·6	8	50·9	85	3·3	10	48·8	80	1·8	7	49·5	77	3·5
June . . .	13	...	...	...	12	57·9	71	0·2	11	60·8	70	0·9	24	58·9	73	1·3	9	56·1	78	4·6	17	58·2	70	2·8	10	55·7	82	1·0	7	56·9	74	0·7	7	58·5	79	1·6
July . . .	16	...	...	...	16	62·1	71	2·9	15	62·2	88	2·9	29	60·1	77	4·2	4	66·6	73	2·3	11	60·3	76	6·0	15	60·3	78	1·7	25	62·1	80	5·0	7	61·1	79	0·9
August . .	17	58·6	78	8·7	16	62·9	77	0·45	13	60·2	80	1·9	18	62·3	76	2·6	22	62·1	72	4·5	33	60·0	77	2·2	20	60·9	77	2·9	40	62·1	76	1·1	28	63·6	78	2·4
September.	26	...	...	...	19	58·8	77	3·3	13	56·4	75	1·3	27	56·9	76	0·5	19	56·8	77	3·9	33	55·3	84	2·4	49	58·1	77	0·7	26	57·1	80	1·1	14	55·2	75	2·8
October .	17	...	...	...	25	51·1	81	2·7	17	47·0	82	1·4	24	52·6	81	1·8	12	47·9	80	3·8	29	50·9	90	4·3	51	49·4	84	2·6	25	51·2	89	4·9	15	51·7	87	1·6
November.	19	45·9	88	7·3	16	44·1	86	1·5	17	46·5	85	2·5	30	37·9	82	0·6	12	48·9	82	6·0	26	42·1	93	1·5	20	40·5	91	1·4	22	41·3	92	1·3	28	40·7	88	1·0
December .	11	...	...	...	6	39·1	90	2·4	14	40·6	92	1·3	25	40·5	69	0·6	18	47·6	79	2·2	13	34·0	91	0·7	16	41·3	87	1·4	24	35·6	79	1·2	5	40·2	90	1·3
(*a*) Spring .	20	...	...	...	15	42·9	84	4·9	17	44·3	79	3·9	28	42·5	84	7·6	25	42·7	81	1·6	26	39·0	78	5·5	26	43·9	80	2·0	22	37·7	85	3·0	26	42·5	81	4·5
(*b*) Summer	33	...	...	...	32	58·0	70	7·0	40	58·1	78	6·2	69	56·6	75	6·3	22	58·0	76	8·8	34	57·9	73	10·4	33	55·6	81	6·0	42	55·9	78	7·5	21	56·3	78	6·0
(*c*) Autumn	60	...	...	...	60	57·6	78	6·4	43	54·5	79	4·6	69	57·2	77	4·9	53	55·6	76	12·2	95	55·4	84	8·9	120	56·1	79	6·2	91	56·8	81	7·1	57	56·8	80	6·8
(*d*) Winter .	39	...	...	...	31	41·1	88	5·5	37	40·2	88	5·0	68	40·4	79	3·9	40	46·2	82	11·8	56	39·5	88	4·2	49	40·2	89	4·5	62	33·9	87	3·5	45	40·1	89	4·9
Total .	152			22·2	138	49·9	80	23·8	137	49·9	81	18·7	224	49·2	79	22·7	140	50·6	79	34·4	211	47·7	81	29·0	228	48·9	82	18·7	217	46·0	82	21·1	149	48·9	82	22·2

TABLE *showing the number of cases of* ENTERIC FEVER *treated in the* LONDON FEVER HOSPITAL, *continued:—*

	1857.				1858.				1859.				1860.				1861.				1862.				1863.				1864.				1865.			
	Cases.	Temperature.	Moisture.	Rain.	Cases.	Temperature.	Moisture.	Rain.	Cases.	Temperature.	Moisture.	Rain.	Cases.	Temperature.	Moisture.	Rain.	Cases.	Temperature.	Moisture.	Rain.	Cases.	Temperature.	Moisture.	Rain.	Cases.	Temperature.	Moisture.	Rain.	Cases.	Temperature.	Moisture.	Rain.	Cases.	Temperature.	Moisture.	Rain.
		°				°				°				°				°				°				°				°				°		
January .	8	36·6	92	2·6	32	37·5	86	0·7	13	40·4	88	0·8	14	39·7	88	1·8	8	33·9	85	0·5	17	39·0	85	1·9	20	41·8	85	2·6	6	36·5	82	0·9	14	36·3	89	2·3
February .	5	39·2	87	0·2	7	34·6	84	1·7	10	43·1	81	0·9	6	35·7	80	1·1	8	42·1	91	1·8	6	41·1	84	0·5	21	42·1	86	0·6	13	36·0	88	0·8	18	36·6	83	1·9
March . .	8	41·8	84	0·8	13	41·4	78	0·9	12	46·4	79	1·3	11	41·1	79	1·9	6	43·8	90	2·2	17	43·1	86	3·7	15	43·9	78	0·7	9	41·3	83	2·7	3	36·6	82	0·9
April . .	4	45·7	82	1·4	5	46·2	76	2·4	5	46·6	78	2·2	7	42·9	79	1·0	3	44·3	85	0·8	4	48·4	81	2·8	4	49·1	78	0·4	14	48·2	74	0·7	6	52·3	73	0·4
May . . .	1	54·0	74	0·6	9	51·7	75	1·8	5	53·1	77	2·4	4	53·8	75	3·9	1	51·9	74	1·8	5	55·4	84	2·8	9	52·0	78	1·3	11	53·8	73	1·9	5	56·1	73	4·4
June . . .	9	61·8	72	2·7	7	64·9	67	1·2	8	61·4	77	1·4	2	54·8	82	5·8	2	59·1	81	1·9	21	56·3	77	1·8	8	58·1	75	3·9	12	57·4	72	0·9	27	60·2	70	2·4
July . . .	19	64·5	71	1·1	13	60·6	72	2·9	12	68·1	70	3·3	7	57·6	83	2·8	10	60·9	78	2·2	21	59·1	78	1·7	14	60·8	72	0·9	18	61·8	70	0·3	26	63·8	72	2·3
August . .	26	65·8	73	2·6	29	62·0	70	1·6	20	63·5	72	1·1	10	57·7	83	3·7	18	63·2	76	0·6	14	59·5	81	3·0	12	61·9	74	1·8	51	59·6	65	1·4	34	59·9	80	4·0
September.	34	59·7	86	3·4	22	60·3	78	0·9	20	56·7	75	3·8	9	53·4	88	3·1	31	57·1	78	1·5	16	57·7	83	1·6	22	53·7	77	3·2	42	56·9	77	2·8	52	63·9	76	0·2
October .	38	52·9	92	4·2	20	50·8	85	1·2	33	50·9	89	3·6	6	50·6	89	1·6	30	54·9	87	0·9	31	51·8	89	4·0	24	51·6	87	1·7	39	50·5	78	1·1	85	51·4	87	5·9
November .	33	45·9	94	1·3	15	39·6	86	0·4	27	42·1	87	2·9	6	40·8	93	2·5	31	40·8	87	5·2	34	39·8	92	1·0	17	45·7	88	1·8	24	42·0	86	2·6	128	45·0	88	2·3
December .	29	45·0	90	0·5	8	41·0	89	1·5	11	36·8	88	2·2	13	36·3	92	2·8	13	41·0	87	1·3	18	43·6	88	1·6	9	43·2	83	1·1	10	38·5	86	0·6	106	43·5	90	0·6
(*a*) Spring .	17	42·2	84	2·4	25	40·7	79	5·0	27	45·9	79	4·4	24	39·9	79	4·0	17	43·4	88	4·8	27	44·2	83	7·0	40	45·0	80	1·7	36	41·8	81	4·2	27	41·8	79	3·2
(*b*) Summer	29	60·1	72	4·4	29	59·1	71	5·9	25	60·9	74	7·1	13	55·4	80	12·5	13	57·3	77	5·9	47	56·9	79	6·3	31	56·9	75	6·1	41	57·6	71	2·1	58	60·0	71	9·1
(*c*) Autumn	98	59·4	83	10·2	71	57·7	77	3·7	73	57·0	78	8·5	25	53·9	86	8·4	79	58·4	80	3·0	61	56·3	84	8·6	58	55·7	79	6·7	132	55·6	73	5·3	171	61·7	81	10·1
(*d*) Winter.	70	42·5	93	4·4	55	39·3	87	2·6	51	39·8	87	5·9	33	38·9	91	7·1	52	38·5	86	7·0	69	40·8	88	4·5	46	43·5	85	5·5	40	39·0	84	4·1	266	41·6	89	6·2
Total .	214	51·0	83	21·4	180	49·2	78	17·2	176	50·2	77	25·9	95	47·0	84	32·0	161	49·4	82	20·7	204	49·5	83	26·4	175	50·2	82	20·0	249	48·5	77	15·7	522	51·2	80	28·6

(*a*) Spring—February, March, April. (*b*) Summer—May, June, July. (*c*) Autumn—August, September, October. (*d*) Winter—November, December, January.

the year. *Second*, that of all the seasons autumn is the one in which Enteric Fever is most prevalent. In fourteen out of the seventeen years, the number of autumnal cases exceeded that of any other season. In one of the three remaining years, 1851, an equal number of cases occurred in the summer and autumn respectively. In the other two years, 1860 and 1862, the greatest number of cases occurred during the winter, exceeding the autumnal cases by sixteen. *Third*, that the disease is least of all prevalent in the spring. Excepting the years 1852, '56, '59, '60, '61, and '63, the least number of cases occurred in spring, and in all these exceptional years there were only thirty-four spring cases in excess of the summer ones.

It appears from these general facts, and from a little closer examination of the table, that Enteric Fever obtains its maximum development in the months of September, October, and November, declines slowly during the winter and spring, and reaching its minimum in May, then begins to increase progressively with the advance of summer.

Let us now go a step further, and endeavour to find out the conditions which, prevailing most in autumn, render this season most favourable to the existence of Enteric Fever.

Temperature.—In every year but 1852, the combined temperature of the autumn and winter was less than the combined temperature of spring and summer, and in this exceptional year the mean temperatures were as 50°·3 to 50°·9. And in every year but 1851, '54, '55, '56, and '61, the temperature of autumn was less than that of summer, and in no year did the autumnal temperature exceed that of summer more than 1°·1. Again, if we except the years 1851, '55, '56, and '61, October —the month when Enteric Fever is most rife—was cooler than May, when the disease is at its lowest ebb. It has been already stated that in five of the years, the number of cases occurring in the spring of those years was in excess of the number which happened in the warmer summers.

Apart from any other cause, it cannot, therefore, be concluded that temperature has any influence in the increase of Enteric Fever.

Rainfall.—In considering the influence of rain upon the quantity of Enteric Fever, attention must be given, not so much to the total yearly amount, as to the quantity which falls in each month. The average amount of rain for each of the seventeen years is 23·1 inches. If only one inch fall during a period of two months, that must be regarded as a season of drought.

Of these seventeen years the most rain, 34·4 inches, fell in 1852, and in this year there were 140 cases of Enteric Fever. Next stands the year 1860, when there was a rainfall of thirty-two inches, and only ninety-five cases—a total considerably smaller than that of any other year. But on further comparison we find that in 1860 the rain was not only abundant, but that each month had a due share, while in 1852 the still more abundant rain was unequally distributed throughout the year, the spring and early part of summer being unusually dry. If now, on the other hand, we regard the influence of drought, we find that

the largest number of cases, 249, occurred in the dryest year, 1864, when only 15·7 inches of rain fell. The next dryest year was 1858; there were only 17·2 inches of rain in this year, and one-third of it fell in the summer months; the winter was the season of drought, and this was associated with an unusual increase of Enteric Fever in January.

With the same amount of rain in the years 1850 and 1854, there is a difference of ninety-one cases of fever, and this may be attributed to the inequality of the distribution of rain throughout the year, which may possibly be greater than is indicated in the table. Thus, for example, the Table is not sufficiently detailed to show that, in 1854, the inch of rain for June did not fall on the first day of that month, and the 1·7 inch on the last day of July, leaving a long interval of drought between—as may have been the case. Mr. Glaisher's laborious and valuable observations are deserving of more detailed study in the elucidation of these questions.

The dry winters of 1851, '53, '55, '58, and '62, were associated with an increase of Enteric Fever.

The opposite effects of drought and rain have been well illustrated during the present summer (1865). Towards the end of July there was a great want of rain, but from the 30th of this month and throughout August there was an unusual amount, large quantities having fallen almost every day. As shown by the admissions into the London Fever Hospital, Enteric Fever was very prevalent during the dry season, but after a fortnight's heavy rain its further progress received a sudden check, which continued until the effects of the succeeding drought became manifest.

It appears clearly from the foregoing observations that the absence of rain furnishes conditions most favourable to the increase of Enteric Fever, and since drought is necessarily associated with dryness of the air and exalted temperature, we must consider it, thus combined, as the one predisposing cause of Enteric Fever.

Other Atmospheric Conditions.—Too little is at present known respecting the influence of ozone in the production of disease, but as this body has been observed to be absent, or nearly so, from the air during the prevalence of cholera and other intestinal affections, the following general statements made by Dr. Moffatt (Chemical News, September, 1861), may be borne in mind. The quantity of ozone varies according to the time of year, the direction of the wind, temperature, atmospheric pressure, and the presence of decomposing substances. Rain, a south wind, fall of the barometer, and increase of temperature, separately or combined, are associated with an increase of ozone, and the reverse conditions with its decrease. "Ozone periods terminate with increasing barometer readings, decrease of temperature, and wind from N. points of the compass." Ozone is most abundant in January, February, and March; less so in April, May, and June; and least of all in July, August, and September. "The greatest number of ozone days is in April, and the smallest in August and November. Whatever tends to a deflection in the direction of the wind leads to a corresponding

result in ozone observations; and a town, chemical works, drains and cesspools, &c., deozonize the air, or wind passing over them" (page 167).

Change of Residence, &c.—Both Louis and Chomel have observed that the greater number of the patients who came under their treatment in Paris had resided there only a short time. But change of residence, apart from the excitement and fatigue, the irregularity of living, and the distress which very commonly attends it, can hardly be considered a predisposing cause of Enteric Fever. In the autumn of 1861 a case of Enteric Fever, which terminated fatally, came under my care in Paris. The patient, a robust, newly-married lady, had been resident there only a few weeks, but during the whole of this time she had voluntarily lived a life of daily excitement and fatigue; the digestive functions were deranged by an unusual diet and irregular mode of living, and to these causes the disease was probably attributable.

M. Chomel found that one third of the 115 cases to which special inquiry was directed had been exposed to sudden cold, to want of food or bad diet, to excessive fatigue, to mental depression, and to debility produced by other diseases.

In his account of the outbreak of Enteric Fever in a garrison of 306 soldiers, Dr. Grossheim says: "It is difficult, if not impossible, to ascribe any deleterious influence to the food—all shared alike." He attributes the disease to the effect of military exercises in a changeable season, with night bivouac in the open air. (Edin. Med. Jour. vol. xlviii.)

(*b*) *Exciting Causes.—Contagion* is supposed by MM. Leuret, Bretonneau, Gendron, Dr. William Budd, and other physicians, to be the means whereby Enteric Fever is propagated. The following examples of the spread of the disease furnish the strongest proof that can perhaps be adduced in support of this view:—

Five persons are successively attacked with Enteric Fever in a certain house in Geneva. A sixth inhabitant of that town spent two nights with the third patient, soon contracted Enteric Fever, and died of it in the hospital. "At the autopsy, ulcerations of the ileum, and all the other lesions characteristic of dothinentery, were found." A clergyman who visited the third patient—a little girl—took the disease and died with all the symptoms of typhoid fever; his nurse was also attacked with typhoid fever, and died in the third week. A young lady also paid the third patient a visit, and rendered her some service in the sick-chamber, and this person soon fell ill with symptoms of typhoid fever, in another house, in which five other persons were subsequently attacked by the same disease. (M. Lombard, Gaz. Méd. 1839, p. 138: quoted by M. Piedvache, Mem. de l'Acad. de Méd. tom. xv. p. 294.)

Dr. W. Budd had seventeen cases of Enteric Fever under his care in the hamlet of North Tawton, Devon, and during the prevalence of the disease three persons left the hamlet ill of the fever.

A, went to Morchard and died there, and ten days after his death two of his children had the fever in the same house.

B, also went to Morchard, and three cases of Enteric Fever afterwards occurred in the house where he lay ill.

C, went to Chaffcombe, seven miles from North Tawton, and nine other cases of Enteric Fever appeared in the farm-houses to which he went. One of these nine left Chaffcombe and went four miles away, to Loosebeare, to be nursed. Several inmates of the house into which this patient was received, were subsequently attacked with Enteric Fever, and from this house the disease extended over the whole hamlet. An infected boy also left Chaffcombe, and took the fever to a cottage midway between Bow and North Tawton, and five persons subsequently fell ill of Enteric Fever in the house into which he was received, and in the adjoining one. Besides these there was no single case of the sort nearer to Chaffcombe than North Tawton. "There were twenty or thirty hamlets in the neighbourhood similar in all respects to Loosebeare. From the soil of all, through month after month of the same fine, dry, autumnal weather, human and other exuviæ exhaled into the air; and yet, while at Loosebeare a large proportion of the inhabitants were lying prostrate with intestinal fever, in not one of the exactly similar places was there a single case." (Dr. W. Budd, Lancet, July 9, 1859, p. 28.)

It is reasonable that those who have witnessed such instances as these should be fully persuaded that Enteric Fever is propagated by contagion. But there are many physicians, and amongst them those who have had the most extensive experience of Enteric Fever, who conclude either that the disease is destitute altogether of contagious properties, or only possesses them in a very slight degree.

That form of Enteric Fever which prevails continuously in London is certainly non-contagious. I have never had cause for the slightest suspicion of contagion in any case which has come under my observation, either in King's College Hospital or in the London Fever Hospital, and this generally is the experience of hospital physicians, both in London and in Paris.

Since writing the above, the following instance, in which there is evidently a strong probability of contagion, has come under my notice. In the present summer (1865), four members, A, B, C, D, of a family of six adult people, residing at St. Peter's Terrace, Notting Hill, were attacked with Enteric Fever. A and B had been residing at Ryde for a month. They returned to town with two other members of the family on the 26th of May. A, suffered ever since his return with diarrhœa, which continued, and the symptoms of Enteric Fever became well developed. "On the 28th of June he had a severe attack of intestinal hæmorrhage, which recurred two or three times daily for several days; eventually he recovered." About the 7th of June, his sister, B, fell ill of the disease. and she died comatose on the 29th of June. On July 10th, C and D, who had not been absent from London, manifested symptoms of Enteric Fever, and were sent into

King's College Hospital, where they came under my colleague, Dr. George Johnson's care. I saw them frequently. They had well-marked Enteric Fever, and are, at this present date, August 22d, slowly convalescing in the Twining ward. On the 8th of August, a nurse in attendance upon these patients was taken ill with the same disease, and now is under my colleague, Dr. Beale's care, in the same ward, in a very precarious state.* This last patient, it must be observed, slept every night at St. John's House, situated at a distance from the hospital, and between it and the Thames ; and a great many isolated cases of Enteric Fever have occurred in London during this month. All but the last patient came under the care of my friend, Dr. Easton, of Connaught Square, and to him I am indebted for the particulars having reference to the period before B and C were admitted into the hospital. Dr. Easton carefully inquired into the sanitary condition of the house where the disease broke out. No cause could be found, and care was taken to mix the evacuations with Condy's fluid and dispose of them immediately they were passed. C and D had scarcely any communication with A and B.

In considering the question of contagion it must be granted that the occurrence of any number of cases simultaneously or successively in any given house or hamlet, can never prove the fact of contagion. The general conditions, moreover, favourable to the increase of the disease, are so common and wide-spread, that one who entertained limited views of the nature of the disease, might account for its propagation among the inhabitants of Geneva, above referred to, for example, by assuming—and not improbably—that the conditions favourable for the spontaneous development of Enteric Fever existed in each of the four or five houses in which the patients resided, and that the intercommunication which took place between them was a curious coincidence—each patient in reality being independently affected. If this explanation be thought satisfactory in the first instance adduced, it cannot be considered otherwise than unlikely and superfluous in the second, in which the general evidence of contagion appears to be complete. It is true that the conditions favourable for the outbreak of Enteric Fever appeared to exist equally in all these little hamlets, and if it had arisen in any or in all without the intervention of an infected person—and it must have so arisen in the first case—the disease in each individual might reasonably have been referred to a spontaneous origin.

M. Gendron himself was unable to account for the first cases in many localities, and M. Piedvache, after a careful examination of the whole question of contagion, "feels almost sure that typhoid fever, under some circumstances, declares itself at once and in sufficient numbers to constitute an epidemic, independently of contagion." (Mem. de l'Acad. de Méd., tom. xv., p. 137.)

* She died on the 25th of this month, and I witnessed the post-mortem examination. There was extensive ulceration of Peyer's patches and enlargement of the solitary glands in the last three feet of the ileum, and these constituted the chief anatomical lesions.

We have now to inquire into the conditions with which Enteric Fever is immediately associated, and the mode of its spontaneous origin.

Spontaneous Origin.—The majority of the French physicians who witnessed the epidemics which occurred in France, from 1841 to 1846, signalize, amongst the causes to which they attribute the manifestation of these epidemics, the following conditions:—The more or less immediate vicinity of stagnant waters, marshes, or bogs, from which, chiefly under the influence of summer heat, effluvia arise and spread over the people—effluvia which tend to produce affections of a periodic type; the presence of dunghills, often accumulated and allowed to remain for a long time upon a public way, before houses, or the single door of some wretched hut; wells of water, level with the ground, permeated with water infected by drains and dunghills; an infected pool existing in the midst of a commune and furnishing only a brackish, muddy, stinking water for the common drink of men and of animals who come to allay their thirst there; or springs, containing, it is true, a pure water and fit for drink, but disturbed by all kinds of animals who go there to drink and corrupt the water with their dung; or further, conduits of impure water, which become a source of infection to the houses near which they pass, or, discharging their contents upon the public ways, form puddles of stagnant water in streets badly kept and unprovided with suitable means for carrying off the fluid accumulations." (M. de Claubry, Op. cit., p, 11, et seq.)

The occupants of a farm house are attacked by Enteric Fever, and the only discoverable cause is an overflowing cesspool, or a stagnant, offensive pond, or a low-lying fold-yard, covered with a thick bed of dung and other refuse matter, from which putrescent runnings sink and saturate the soil in which the well, supplying the house, is excavated.

The accumulated or pent-up sewerage of a town escapes into the subjacent soil within and about it, soaking into the wells and defiling the drinking water, and giving off filthy emanations into the air, and an outbreak of Enteric Fever follows.

A particular drain becomes obstructed, bad odours arise into the houses in communication and sicken their inhabitants, and Enteric Fever soon manifests itself.

Such are the almost constantly observed conditions with which Enteric Fever is associated, and we must therefore conclude that this disease has a spontaneous origin in putrescent matters—that these, when preserved from the purifying influences of air and water, generate a poison, which when admitted into the body produces Enteric Fever. Leaving for the present all speculations as to the nature of the poison thus generated, we will now proceed to inquire how the poison or poisons gain admission into the system—whether by the lungs or by the alimentary canal. The inquiry is an important one, and we must be careful to avoid the influence of partial views. If we except the most thoroughly-drained towns (such as London, where, perhaps, Enteric Fever attains its minimum development), wherever

the air is vitiated by filthy odours, the subjacent soil is permeated by the putrescent source from which they arise, and the water is also contaminated. Hence, in many cases, it may be difficult to determine whether the poison were conveyed by the air or by the drinking water. Dr. Murchison, in his elaborate work on the Continued Fevers of Great Britain, endeavours to prove that Enteric Fever arises from "sewer emanations." "So far as we know," he says, "it is necessary for the production of the poison of Enteric Fever that the matter undergoing fermentation be either in a confined space as in a drain or sewer, or that it be in a state of stagnation. Free exposure to the atmosphere, or constant dilution in a running stream, may not only render the poison inoperative, but may altogether prevent its formation. A privy outside a house is much less dangerous than a badly-appointed water-closet within" (pp. 452–53). In the instances which he adduces to support this view nothing is said respecting the water-supply. Assuming that there were no sources of water within the precincts of the buildings, the outbreak of fever in the Westminster school—shortly after the exhalation, from a foul and neglected sewer, of a disagreeable stench, so powerful as to induce nausea—appears, pretty clearly, to have been due to the foul air. In outbreaks of disease amongst bodies of soldiers, school-children, &c. we must be prepared to look for the cause abroad as well as at home. A body of young cricketers, for example, may quench their thirst in some impure stream, and thus contract a disease, for which some apparent cause may readily be discovered at home. There can be little doubt that Enteric Fever is occasionally generated by exhalation from putrescent matters, but usually, we believe they are ineffectual in the production of the disease. It has never yet been proved experimentally that Enteric Fever may be generated by emanations from decomposing animal and vegetable matters. Nor does it appear from the observations of those who have made special investigation in this direction, that individuals whose occupations require them to spend much of their time in an atmosphere thus contaminated, evince an unusual proclivity to Enteric Fever. Dr. Guy compared the past and present condition of ninety-six nightmen, with about the same number of bricklayers, labourers, and brickmakers, and after a most critical investigation, he says: "An examination of the tabulated results of his inquiries must convince the most sceptical that the health of scavengers is fully equal to that of the labouring man with whom they are compared." (Journal Statis. Soc., 1848, vol. ii., p. 79.) This agrees with the observations of M. Parent Du Chatelet and others on the health of men who work in sewers. In the country it is a common practice to empty the privies and spread their contents over the gardens or adjoining fields. The filthy odours are endured as a temporary inconvenience, but experience proves that the practice is a harmless one. In two instances I have known the inhabitants of a house to be exposed for months to the direct emanations—in the one case, of a large cesspool, in the other, of a common sewer. In both

ases a leaden pipe, in communication with the water-closets, was arried down inside the house and thence into the sewer or cesspool. After several unsuccessful explorations it was discovered that rats had aten a large hole in the pipe leading to the cesspool, and through this perture the fætid exhalations from its surface arose directly into one f the sitting-rooms and a passage of the building, and on hot and lamp days the effluvia were intolerably offensive. The cesspool was mptied at this time, and I witnessed the process. The contents were emi-fluid, of a dirty-black colour, and the surface of the pool was overed with large bubbles of gas. Now, although several persons were continually exposed to filthy exhalations, in the one case for many months, and in the other for several years, none suffered from liarrhœa or Enteric Fever. Numerous examples of this kind teach us that we must not be too ready to attribute Enteric Fever to foul air, but that we should be prepared to acknowledge other means by which the disease may be introduced into the system. Of these we may consider two,—impure water, and bad food.

The following instance is worthy, from the simplicity of the attendant conditions, of attentive consideration with reference to the spontaneous origin of Enteric Fever. An outbreak of Enteric Fever occurred at Stangenrod, "a village chiefly seated on a naked, exposed, isolated eminence. Trees, excepting young brushwood, are not seen in the neighbourhood, and there are but few marshes; a small stream has its source at some distance, but scarcely touches the extreme boundaries of the district. In several places are flats covered with broom and used as pasture grounds. The basis is mostly basaltic rock, covered with a layer of clay and loam mixed with sand and flint (!) The air is keen and pure, and the atmosphere rarely disturbed by clouds. The position of the town is healthy as to local influences, and not favourable to the production of endemic disorders, which, it appears, had never been observed in it. The inhabitants were poor and chiefly occupied in agriculture and pasturage; comfort and wealth were exceptions. The houses were small, low, dirty, and surrounded by dunghills. The general want of spring-water the inhabitants attempt to supply by collecting rain-water in bad reservoirs." (Dr. Ebel, Ed. Md. and Surg. Jour., 1837, vol. xlviii., p. 160.) The disease appeared at the close of July, 1833, and terminated in April, 1834. The spring of 1833 was dry, followed by a dry summer, with insufferable heat, continuing to autumn without rain, and with little wind (p. 187). 157 out of 318 inhabitants were attacked, and 19, or 12·1 per cent., died. Dr. Ebel believed that the chief cause of the disease consisted in "the entire want of good fresh water and the use of corrupted water. The inhabitants of the village used for domestic purposes rain-water obtained from marshes, and preserved in insufficient reservoirs until required" (p. 188).

In the latter part of 1859 a severe outbreak of Enteric Fever occurred at Bedford, and there was every reason to believe that it was due to fæcal matter soaking into the wells from the numerous cess-

pools of the town. The water from these wells was found to contai a large quantity of decaying animal matter, evidently derived from th sources alluded to. (Simon, Report to Privy Council, 1860.) Earl in October, 1847, "intestinal fever" broke out almost simultaneousl in thirteen houses in a certain terrace at Clifton. The houses wer far apart in the terrace, and there was little or no intercourse betwee their inmates. The inhabitants of these thirteen houses drew thei drinking water from a well situated at one end of the terrace, and a the end of September it became evident from the taste and smell o the water from the pump, that it was tainted with the contents o the sewer. The remaining twenty-one houses were supplied witl water from another source. (Dr. W. Budd, Lancet, 1859, p. 432. Other instances of the direct association of Enteric Fever with de fective drainage and contaminated well-water may be found in th sixth Report to the Privy Council, 1863.

Rain, the natural preventive of Enteric Fever, may, under certai local conditions, be the means of diffusing it. This appears to hav been the case at Festiniog.

The houses in which the disease appeared, are situated on the slope or bases of mountains on the sides of the valley stream. "Th majority have no privies or ash-pits, nor have their inhabitants acces to places of this sort. The custom of the neighbourhood is to use th fields, or when house utensils are employed to empty them at a dis tance from the houses. Houses in a row are generally provided witl one or more privies, with cesspools common to the row. The air i pure and the natural drainage good; the valley stream is exposed t constant contamination. The inhabitants stated that water for interna use is got from wells on the mountain side, presumably situate abov any possible source of pollution" (see the Report to the Privy Council by my colleague, Dr. Buchanan; Sixth Report, 1863, pp. 787–8); but they acknowledge that they use the water of the stream in the valley for some domestic purposes, and it is obvious how readily this may be substituted for the purer, on all occasions, and particularly when the distant spring fails, and laziness or lack of time constrains the water carrier.

Under such conditions as the above, filth accumulates upon the surface during a dry season, and remains harmless there till drenching rain gradually washes it down into the common stream, which thus becomes continuously contaminated for weeks or months. Dr. Buchanan has pointed out these conditions, and is inclined to attribute the prevalence of the disease during an unusually *wet* autumn to water contamination, combined with exposure to cold and wet.

Impure water appears to be equally a cause of intermittent fever and its complications. The inspector of hospitals writes of Walcheren during the prevalence of the severe intermittent fever there: "The bottom of every canal that has communication with the sea, is thickly covered with an ooze, which, when the tide is out, emits most offensive and noisome effluvia; every ditch is filled with water which is

loaded with animal and vegetable substances in a state of putrefaction ; and the whole island is so flat, and so near the level of the sea, that a large proportion of it is little better than a swamp ; there is scarcely a place where water of a tolerable good quality can be procured." Sir John Pringle mentions "that the men-of-war which lay all the time at anchor in the channel, between South Beveland and Walcheren, even during the worst period of the distemper, were not affected with either flux or fever, but enjoyed the most perfect health." (Davis on the Walcheren Fever, 8vo. 1810, p. 15.) These sailors were doubtless provided with a supply of good water.

The inhabitants of a marsh, seated in a basin of clay, or level with the bed of a river, must of necessity drink water contaminated by their excretions and other impure matters, if the water be derived from the marsh itself, and the dryer the season the more concentrated the poisonous impurity.

Dr. W. Budd most strongly insists that the essence of Enteric Fever is contained in the alvine dejections of the patient, but we cannot adduce any facts recorded by himself that give material support to this view, and our own observations lead us to the conclusion that the intestinal discharges do not contain any *volatile* poison, at least, which is capable of generating Enteric Fever.

Food, in an incipient stage of putrefaction, is also capable of generating symptoms and intestinal lesions apparently identical with those of Enteric Fever.

Dr. Kerner of Weinsberg has collected 135 observations of poisoning from eating a certain kind of smoked puddings, which he regards as putrid food. They are chiefly composed of animal matters, and have a putrid savour and odour. Post-mortem examinations revealed often traces of inflammation of the œsophagus and pharynx ; gangrenous patches of the stomach ; intestines inflamed in divers places, or even gangrenous in part ; lungs strewn with black spots, or hepatized. (Orfila, vol. ii. p. 636. 1843.) Dr. Schumann records the symptoms and post-mortem appearances produced by eating similar food. The symptoms were those of Enteric Fever, *plus* inflammation of the pharynx, œsophagus, and larynx. Post-mortem examinations revealed inflammation of the intestinal canal : "L'intestin grêle, quelquefois très distendu par les gaz, présenti des traces d'inflammation très intense, et souvent des plaques gangréneuses." Lungs gorged with blood. (Archiv. Général de Méd. tom. xxii.)

Granting that Enteric Fever may be produced by the ingestion of putrid animal substances, we shall be at no loss to find a cause for the origin of many of the isolated cases which occur, for such may exist in every household. There is nothing, for example, more essentially putrid than the *decomposed cheese* with which many persons habitually indulge their appetites, and persons unaccustomed to such food can hardly be supposed to partake of it with impunity. It is a matter of common experience that an *egg* will sometimes produce vomiting and purging.

With regard to the identity and nature of the poisonous agent o agents which produce Enteric Fever, we know nothing. It has neve been demonstrated that any particular gaseous body can induce th lesions found after death from Enteric Fever. There are, howeve both mineral and vegetable substances which, when introduced int the stomach, produce symptoms and morbid changes, if not identica with those of Enteric Fever, at the least, hard to be distinguished fro them. Thus, to take vegetable substances:—twenty-four hours aft the ingestion of *poisonous mushrooms*, the members of a family wer taken with nausea, and the next day frequent vomitings of biliou matters, and abdominal pains, of which symptoms three children die The other members had insupportable pains in the stomach, loin and abdomen, meteorism, retention of urine, tenesmus, glairy sar guinolent stools, vomiting, and great thirst. On the fifth day, shiverin collapse, and death.

The stomach and intestines were found covered with whitish o yellowish mucus, the valvulæ conniventes and mucous follicles gene rally very prominent. (C. P. Galtier, Traité de Toxicologie, tom. i pp. 564–569.)

The effects of *colchicum* still more closely resemble those of Enteri Fever. Two young women took each about ʒiv. of tincture of col chicum. Both died of violent gastro-intestinal inflammation. Th viscera of one were tied up and sent away for analysis. In the othe who died twenty-eight hours after taking the poison, the lungs wer healthy, stomach distended by gas, and the mucous membrane evi dently softened. Throughout the whole extent of the intestine th muciparous follicles were of the size of millet seeds, and in the inferio third of the ileum the plates resulting from the agglomeration of th mucous crypts were also much developed and of a violet colou (Galtier, loco citato, p. 322.)

In poisoning by *Cicuta virosa* similar symptoms and swelling of th glands of the intestine are produced.

Has the poison which so frequently generates Enteric Fever an relation to the elaborated narcotico-acrid principles of these or othe plants? If so, is it generated in the process of decomposition, and i it possible to obtain it by lixiviation of the impure soil, or by precipi tation from the contaminated water? Or again, is the poisonous agen merely a common product of decomposition, and destitute, like tha common contagious sanies which so readily induces phlebitis or erysi pelas, of any specific character? Such are the speculations into whic further inquiries respecting the origin of the disease lead us.

Returning now to the facts above detailed, we may conclude (1) that refuse animal and vegetable matters, if allowed to accumu late and decompose in seasons of drought, generate a poison which if not washed away or diluted by sufficient rain, rises into the air, o becomes diffused in the water; and which, when introduced into the body by these media, may produce Enteric Fever; (2) that food o water rendered impure under conditions less general, may also be the

means of inducing the same disease; (3) that there can be little doubt that the usual symptoms and post-mortem appearances of Enteric Fever may arise during the progress of several other acute diseases as a consequence of a general inflammatory condition.

Diagnosis.—The indications of inflammation and ulceration of Peyer's patches, are the following :—Pain and tenderness in the right iliac fossa; general derangement of the alimentary canal, accompanied by persistent diarrhœa; light ochre-coloured watery stools; hectic fever; and the eruption of rose-coloured papules. If these symptoms be associated with any febrile condition or complication whatever, we may be sure of the presence of enteric inflammation. If they are absent, the case may be one of commencing pneumonia, erysipelas, pyæmia, puerperal fever. But each or all of the symptoms of enteric inflammation may be latent, and our attention may, therefore, be altogether called away from the abdomen to the head or the chest. In the absence of diarrhœa, the other characteristic symptoms being present, we may assume, generally, that the intestinal glands are simply inflamed and swollen; the presence of the pale, watery, flocculent stools, on the other hand, may be taken as indicative of the ulcerative stage. Diarrhœa alone, or even associated with a febrile state, does not furnish conclusive evidence of intestinal lesion; but there is one unmistakeable evidence occasionally present, from which, in the absence of every other symptom, we may positively declare that the agminated glands of the ileum are in a state of sloughing inflammation; it is the presence of a fragment of a disintegrated Peyer's gland in the stools. If the flocculent debris, when examined under water by the aid of a pocket lens, present a number of minute, closely-placed follicular depressions with minute circular orifices, loosely embedded in a ragged fibrous stroma (fig. 8), we have direct and positive evidence of the nature and progress of the disease. Even while the pale stools are still solid, a shreddy fragment presenting these unequivocal characters may be found adherent to their surface. To apply the test, the stools should be strained through a little cap net, the matters arrested thereby should then be washed, floated in clear water, and examined with a common pocket lens. The structure of the agminated gland is quite distinct from that of any other tissue in the body, not even excepting the thyroid gland and tonsils. Cellular vegetable structures, such as the rind of an orange, may be mistaken for the intestinal slough, but these are distinguished by their softer and more pulpy texture, and by their vegetable qualities. If there be much fever, with headache and delirium before the abdominal symptoms are developed, Enteric Fever may be mistaken for several other acute diseases, such as scarlatina, variola, typhus. In the first of these diseases we have the same bright cornea and flushed face, and the same lively character of the delirium. When characteristic symp-

FIG. 8. nat. size.

toms are absent, we must suspend our diagnosis for a day or two, using at the same time, precautionary measures against contagion. If the rash and sore throat of *scarlatina* be but slightly developed, or if the rash have receded, the diagnosis will be difficult and unsatisfactory.

If, in the accession of *variola*, the severe lumbar pain be absent and the eruption make its first appearance as a few isolated papules upon the chest and abdomen, the case may be doubtful for a day.

Chronic tubercular peritonitis presents many of the symptoms of Enteric Fever. Hectic flush, pinched features, abdominal pain, tenderness, gurgling, and diarrhœa are common to both diseases. But in tubercular peritonitis the tongue is clean and moist, there is no eruption, and frequently the abdomen is distended with fluid effusion; moreover, there may be evidence of tubercular deposit in the lungs.

Tubercular ulceration of the intestines, with tubercular deposit in the mesenteric glands, is a condition frequently mistaken for Enteric Fever. Two of M. Louis's cases, (Obs. xliii. xliv. vol. ii.) given as examples of "latent typhoid fever," are instances of general tuberculosis simultaneously affecting the lungs and the intestines. I have already included another case (see case 12) recorded by this author (Obs. xxxiv.) under Tuberculosis, on account of the co-existence of miliary tubercles in the lungs and ulceration of the glands of the ileum, regarding the lesions in the chest and abdomen as simultaneous manifestations of the same pathological condition. If the lungs had presented evidence of only common inflammation, there would have been no reason for distinguishing this case from Enteric Fever. Indeed, the distinction between acute phthisis simultaneously affecting the lungs and intestines, and Enteric Fever, will more often turn upon the difference between tubercular and simple pneumonia than upon a difference in the character of the intestinal lesions. Inasmuch as the lungs are so commonly affected with inflammation in Enteric Fever, and the tubercular ulceration induces all the more prominent symptoms of Enteric Fever, such as hectic, abdominal tenderness, tympanites, diarrhœa, and even intestinal hæmorrhage; the diagnosis is often exceedingly difficult. If the patient have been long declining in health with emaciation, sweating, cough, and expectoration, and we find dulness at either apex of the lungs, gurgling, or amphoric breathing, we may set down the case to be one of phthisis. Doubtless, it is possible for tubercle to be deposited nowhere else in the body but in the solitary and agminated glands of the intestine, and in the neighbouring mesenteric glands; and, in such a case, the diagnosis between the two diseases, hardly or not at all to be obtained during life, would turn upon the distinction between tubercular deposit and ulceration, and the nature of the inflammatory process and ulceration in Enteric Fever. I have examined the intestinal lesions of individuals in whom, after death, the lungs have been found consolidated with tubercles, and excavated into ragged cavities at their superior parts, side by side with the corresponding abdominal lesions of Enteric Fever. In the early period of the tubercular disease, I have been unable to detect any difference

in the morbid phenomena; both diseases fall with greatest severity upon the solitary and agminated glands of the lower third of the ileum, and the appearance of the ulcers is similar, except that in Enteric Fever the inflammatory action and swelling is usually greater; in both diseases the contiguous mesenteric glands have the same violet colour, soft consistence, and increased size. The diseased parts offer the same microscopical appearances; but the corpuscles of the inflamed glands within and without the intestine are a little smaller in Tuberculosis than in Enteric Fever. In the advanced period of the tubercular disease, however, the ulcers are very distinct from those of Enteric Fever; they have an irregularly circular, thick, often indurated, elevated, angry-looking border, inclosing, and here and there continuous with, large interrupted irritable granulations, between which little yellow masses of tubercular matter, firmly attached to the base of the ulcer, are to be seen. In chronic cases, moreover, and before ulceration has begun, the swollen intestinal and mesenteric glands are free from inflammation, and the tubercular matter within them has a white, opaque appearance. It frequently becomes hard, gritty, and cretaceous, and sometimes forms compact stony calculi.

The disease, however, with which Enteric Fever is most frequently confused, is *typhus*. In our own country, Willis, Sydenham, Huxham, and other acute observers, in every generation, have recognised and asserted the distinction between these two fevers, but a general confusion of the diseases has, nevertheless, prevailed amongst the members of the profession, until within some twenty years ago, and we are greatly indebted to Dr. A. P. Stewart of the Middlesex Hospital, and to Dr. W. Jenner, for reasserting and proving that a distinction really exists, and for rendering the diagnosis between the two diseases more clear and distinct. What these observers have done for England, Dr. H. C. Lombard of Geneva, Messrs. Gerhard and Pennock of Philadelphia, Hildenbrand and Griesinger in Germany, and Forget, Godélier, Barralier, and others in France, have done for their countries.

Still, there are physicians who, either from partial views, or from insufficient experience of the two diseases, do not recognise any specific difference between them, and regard the abdominal lesion merely as a complication of typhus. From what has been said on the associated pathology of Enteric Fever, it may, perhaps, be argued that the abdominal lesion, which is assumed to be characteristic of Enteric Fever, is nothing more than a local result of a common febrile disorder of the system; yet it is remarkable that lesions of Peyer's patches, which may sometimes be found in every other acute disease, are never, I believe, found in typhus, in which the febrile condition is both very general and very prolonged. I have examined the intestines in a great many cases of typhus, with the exclusive view of detecting, if possible, some participation of Peyer's patches in the general inflammation, but have always failed to detect either swelling or ulceration.

Case 20.—Three months ago, a woman, aged 30, and her little daughter, came under my care, with well-marked symptoms of typhus.

The hot dusky skin of both patients was maculated with a distinct mulberry, typhus rash, which in the mother was petechial on the twelfth day of the disease. On the following two days the rash was still more plainly marked, and the case offered a good example of "spotted fever." There were no gastric or intestinal symptoms; sordes formed on the teeth, and the tongue was dry and brown; the eyes were dull and suffused; the mind heavy and confused—in short all the symptoms of typhus were most distinctly marked. On the fifteenth day the bowels became loose, and a considerable quantity of blood was passed *per anum* the same day. At 11 A.M., on the sixteenth day intestinal hæmorrhage was again declared by the passage of much clotted blood. The hæmorrhage continued during the day, and at one time the bed was saturated with it and it ran down upon the floor. She sank and died at 5·45 P.M. the same day. I was induced to re-examine carefully the skin of her little daughter who lay in an adjoining bed. A dark typhus rash was still out upon the chest and abdomen, and there were no traces of abdominal mischief.

On post-mortem examination of the body of the mother, which was well developed and well nourished, I found the small intestine perfectly healthy and pale; every Peyer's gland was also pale and healthy, and no solitary gland was either enlarged or prominent. The mesenteric glands and spleen were normal in size and appearance. In the cæcum an inch and a half beneath the margin of the ileo-cæcal valve, I found a circular ulcer of the mucous membrane a quarter of an inch in diameter, the surface was greyish-white, like an aphthous ulcer of the mouth, the margin was slightly excavated, slightly raised and vascular. On the opposite wall of the cæcum, a little higher up where it becomes ascending colon, there was another much larger ulcer; it was an inch and a half long by half an inch wide, and it lay across the bowel; the surface was irregularly excavated, clean and pale; the margins irregular and sharp; it extended below the mucous membrane, and lay in the thickened areolar tissue. In the transverse colon there were eight other small ulcers, resembling the first one, but deeper, and with margins more sharply cut and vascular. Excepting the largest, all the other ulcers were placed over one or other of the bands of longitudinal muscular fibres. Seven were arranged in a row upon one of them, at distances of about an inch. The intervening mucous membrane was congested, but not swollen. the ulcers were plainly the source of the hæmorrhage.

Such are the characters and situation of the intestinal lesions in typhus fever when they occur, but they are very uncommon. They do not appear to commence, like tubercular ulcers and the ulcers of Enteric Fever, in the solitary and agminated glands. In the case last described, the solitary glands contiguous to the ulcers were perfectly healthy. If we now compare the general symptoms of the two diseases we shall find equally well marked differences. The countenance in typhus is dusky, or suffused with a dusky blush, which spreads continuously over the face, neck, and shoulders; the eyes are injected

and the pupils contracted ; the expression is heavy, the intellect dull and the delirium generally quiet. In Enteric Fever, the expression is bright, the pupils are dilated, and the hectic blush patchy, and limited to the cheeks ; the delirium is often intermittent, becoming worse at night, and disappearing during the day. Its character is more lively than that of typhus. The eruption in typhus is a mere indistinct passive congestion, soon becoming a minute extravasation, and forms no distinct elevation. The rose spots of Enteric Fever are raised inflammatory papules. Diarrhœa, often profuse, frequently accompanies typhus, but the stools are always dark ; the bile is thick and dark coloured. The patient has no peculiar odour in Enteric Fever, but in typhus the disgusting exhalations from the skin are so strong and peculiar, that we may often diagnose typhus by means of the nose alone. Typhus runs a regular course, and is terminated in the third week. Enteric Fever has no regular course, no certain date of termination. Typhus kills by coma or congestion of the lungs, Enteric Fever by asthenia, pneumonia, diarrhœa, hæmorrhage, or perforation —very rarely by coma.

Prognosis.—The prognosis in Enteric Fever must be formed with extreme caution ; the worst accidents of the disease sometimes occur when all appears to be going on well. The mortality, however, is not great. Out of 18,602 cases, there were 3,447 deaths, or one in every 5·4. (Murchison, p. 529.) A pulse continuously frequent, and much hectic or obstinate diarrhœa, are very unfavourable symptoms. Hæmorrhage, to any considerable extent, associated with tympanites, and occurring at a late period of the disease, is an equally unfavourable symptom. If there be excessive tympanites and abdominal pain, there is little hope. A fatal termination must also be anticipatep if the stupor or delirium becomes continuous, and associated with muscular twitchings. The delirium sometimes assumes the traumatic character, or the patient becomes obstinate as well as stupid ; such features also forebode an unfavourable issue.

On the other hand, we hail a fall in the temperature of the skin and the appearance of a copious eruption of sudamina over the abdomen and chest as most favourable indications.

Treatment.—The early recognition of enteric disease is of the utmost importance, for its progress is frequently so very insidious that many patients go about their usual occupations at a time when Peyer's glands would present very grave lesions (*e.g.* case 4), and complaining of nothing more than loss of appetite and debility. Our suspicions must be on the alert in such cases, and, before all things, we must ascertain the condition of the alvine secretions. Long before diarrhœa sets in, the well-formed fæces may be observed to be of a light-yellow or ochre colour—a condition in which they may exist in the absence of diarrhœa, but at a time when the intestine may be gravely ulcerated. The indications in the early period of the disease

are to relieve internal congestion, and to revive the function of th liver. If the bowels be confined, a dose of castor oil, or of compoun rhubarb powder should be given. If the skin be inactive, the ho bath should be used, and a diaphoretic, composed of aromatic spiri of ammonia and acetate of ammonia, prescribed. With the view o arousing the liver to activity, I have given the following every thre or four hours, for two or three days, until some improvement wa manifest in the condition of the alvine secretions. When necessary I have continued the administration of the mercurial until its con stitutional effects—slight tenderness of the gums and fœtor of th breath—began to appear.

℞ Hydrargyri cum Cretâ, gr. iii.
Pulvis Cretæ aromaticæ cum Opio, gr. v.
Sodæ bicarbonatis, gr. xx. Misce, et fiat pulvis.

If this relaxes the bowels, I have combined it with a little mor of the chalk and opium powder, or suspended its use altogether, an trusted to infrictions of mercurial ointment into the groins or arm pits. I have employed this treatment in all cases which have com under my care in the early period of the disease, before diarrhœa ha become severe, and have reason to believe that marked benefit ha resulted therefrom, for the subsequent course of the disease in thes cases has been uniformly mild. Calomel should be avoided; its actio is too irritant. Saline purgatives and the vegetable cathartics mu never be employed in the treatment of this disease at any perio A single dose of jalap, scammony, and the like, may suffice t develop the worst features of the disease. If, at an early period, w succeed in producing a flow of healthy bile with moderate action o the bowels, we may arrest further progress of the disease and resto the appetite. If there be diarrhœa and sickness from the commenc ment, we may prescribe an ounce of chalk mixture with ten grains o subnitrate of bismuth and five minims each of tincture of opiu and dilute hydrocyanic acid, every two or three hours. This usuall succeeds in allaying the vomiting. For simple vomiting of sou bilious fluid, a mixture, containing thirty grains of bicarbonate o soda and five minims of dilute hydrocyanic acid, is very serviceabl The acid condition of the secretions in the upper portion of the al mentary canal, and the deficiency or total absence of alkali from th bile, are facts to be borne in mind in the treatment of Enteric Fever.

If the disease exhibit an intermittent character, quinine, gr. v. to ʒ may be given every evening. In the absence of cerebral or gastri disturbance, quinine is a most valuable remedy for subduing th evening exacerbations of fever so frequently present. Grains iii. to ʒ may be given in a glass of water, with this view, every or every othe day at noon.

In the further progress of the disease, our treatment will have almos exclusive reference to the abdominal lesion.

Diarrhœa must be restrained, some physicians think checked, if pos sible, altogether. My own experience, however, leads me to believe tha

moderate diarrhœa in the early period of the disease is beneficial in some cases, and more especially those in which delirium appears early. In the congested condition of the abdominal viscera which exists in Enteric Fever, one or two liquid stools in the course of the twenty-four hours doubtless acts beneficially in all cases, and our object in the early period of the disease should be to keep the diarrhœa within moderate limits, rather than stop it altogether. In the early period, chalk and bismuth, with catechu and opium, is usually all that is needed to check the diarrhœa and allay irritation. As soon, however, as the diarrhœa becomes excessive, or we have reason to suspect ulceration, stronger astringents must be given. Some physicians use sulphuric acid with opium—℞ acidi sulphurici diluti, ♏xxx.; tincturæ opii. ♏x.; decocti cinchonæ, ℥iss.; fiat haustus, quartis horis sumendus. We prefer the styptic salts, having found them much more efficacious: indeed, the acid mixture often increases the purging and pain. Acetate of lead, nitrate of silver, and sulphate of copper are employed. The first may be given in the form of mixture—℞ plumbi acetatis, gr. iii.–v.; acidi acetici, ♏iii.; morphiæ acetatis, gr. ⅛th; aquæ cinnamomi, ℥iss.; fiat haustus, quartis horis sumendus. Acetate of lead is a very suitable and efficacious remedy, but its continued use in Enteric Fever should be avoided, as it may subsequently affect the system injuriously. Dr. Tweedie and M. Trousseau speak in high terms of nitrate of silver. It may be given combined with a grain or two of compound soap-pill in doses of a quarter of a grain to one grain, every three or four hours. Dr. Tweedie says: "I have prescribed it extensively in Enteric Fever, and continued its use for a considerable time, and have never witnessed any approach to discolouration of the skin." (Lecs. on Continued Fevers, p. 233.) Of all medicines, we consider sulphate of copper to be the most efficacious in restraining the diarrhœa of Enteric Fever. We may give it in quarter grain doses, combined with two grains of compound soap-pill, to be taken every two, three, or four hours. If need be, the dose may be increased to a grain, a day or two afterwards. For children, it may be prescribed in doses of the eighth or sixth of a grain. If too large a dose be given at first, it may excite vomiting. In small doses we have often prescribed it when there has been considerable irritability of the stomach, in which cases it appears to act as a sedative. Alum, catechu, tannic and gallic acids, krameria, hæmatoxylon, &c. are of comparatively little value in the treatment of Enteric Fever.

Starch and opium enemata—(Mucilaginis amyli, ℥iv.; tincturæ opii. ♏xv.–xxx.; fiat enema, nocte—vel nocte maneque injiciendum)—are of great value in allaying that irritability of the lower bowel wh;ch often induces purging. When enemata cannot be retained, we may still use suppositories. (Pilulæ saponis compositæ, gr. v. to gr. x.)

Abdominal pain and tenderness.—The disease being localized in the right iliac region, we must direct our remedies to this part. Hot sedative fomentations, turpentine stupes, or poultices containing an

admixture of mustard, should be frequently applied to the abdomen. If there be much tenderness four or six leeches should be applied, partly to the right iliac region and partly around the orifice of the bowel. Leeching of the anus is the most effectual mode of relieving the intestinal congestion. If the pain be great, an occasional full dose of opium will be needed.

Tympanites.—If there be any increased fulness of the abdomen, a flannel or linen bandage should be placed around it. In commencing tympanites we regard this as a very important part of the treatment, as it at once diminishes the congestion of the inflamed part, and prevents injurious distension. It also gives support to the painful abdomen in the process of respiration. Folds of wet cloths may be interposed between the bandage and the abdomen.

If the tympanites be considerable it becomes a most distressing symptom, and the life of the patient is in great danger from distension of the diseased and attenuated bowel; laceration of its ulcerated coats being imminent so long as the distension continues. To relieve this painful and dangerous condition, turpentine stupes should be applied over the whole of the abdomen, and gentle support given by means of a thin flannel bandage. An assafœtida enema (℥xii. ad ℥xx. enematis assafœtidæ P.B.) often gives much relief. If we should fail, however, to cause expulsion of the air by this means, a long elastic tube with wide side openings may be passed into the colon and retained there at intervals. Dr. Tweedie speaks well of the use of the stomach pump, per rectum, in the relief of this condition. "I have applied it," he says, "in some cases with happy effects, and withdrawn the accumulated air which may be passed through the lower tube of the stomach pump into a basin containing water." (Op. cit. p. 237.) Oil of turpentine (♏x.–xx.), or oil of rue (♏iii.–v.), combined with opium and given by mouth, are often serviceable in the relief of pain and flatulent distension.

Intestinal Hæmorrhage.—Moderate capillary hæmorrhage from the general mucous surface of the bowel must be regarded as beneficial, and we should employ no means to check it, but if the blood be clotted, in large quantity, and unmixed with mucus, we must fear the erosion of a large vessel, and treat for such an accident very promptly. A bladder of ice bandaged upon the right side of the abdomen, and the internal administration of gallic acid, solution of perchloride of iron, acetate of lead, or turpentine, are the most hopeful means of arresting it. Sulphate of copper in combination with soap-pill is a very valuable remedy in this condition also, and one upon which we are inclined to place most reliance. If the patient have been previously taking the copper salt, the dose may be increased at once to one or two grains. Turpentine in doses of ten or fifteen minims given every half-hour or hour, is often effectual in stopping the hæmorrhage, and is especially useful in cases where there is a tendency to syncope. The solution of perchloride of iron of the British Pharmacopœia is a very valuable remedy for intestinal hæmorrhage; ♏x.–xx. in a wine-

glassful of water may be given by mouth every two or three hours. If the hæmorrhage be slight and the arterial action much excited, ℥xv. tincturæ digitalis, with ℥xxx. tincturæ ferri perchloridi, ℥jss. aquæ menthæ piperitæ, may be given every four hours. This may be administered alone or in combination with thirty minims of dilute sulphuric acid. If we fail to arrest the hæmorrhage by these means, the bowel may be injected with one or other of the following enemata. ℞ plumbi acetatis, gr. x.; acidi acetici, ℥x.; morphiæ acetatis, gr. ½; aquæ tepidæ, ℥iv. misce. ℞ liquoris ferri perchloridi, ℥xv.; morphiæ hydrochloratis, gr. ½; aquæ tepidæ, ℥iv. misce.

Cerebral Symptoms.—The indications in the treatment of cerebral symptoms are to relieve congestion and procure sleep. If there be much pain and heat of the head, cold water may be applied as an occasional douche, a gallon being poured in a gentle stream upon the head as often as the heat becomes excessive. Rags wetted with water, or spirit and water, may be applied in the intervals. If this treatment fail to restrain the vascular excitement, a few leeches should be applied behind the ears, or a blister upon the nape of the neck. As often as they are required, full doses of opium should be given to procure sleep. In the majority of cases the cerebral affection is mild and requires no direct treatment, and the sedatives given to relieve the abdominal symptoms are usually sufficient to calm the nervous irritability and procure sleep. When the pulse is fast and feeble and there is pulmonary inflammation, we must be careful to avoid large doses of opium. In some cases the delirium makes the patient obstinate, and he persists in refusing food and drink and keeps the teeth firmly clenched. In such a case, with diarrhœa present or impending, we cannot feed *per rectum;* we must therefore gag the patient and use the stomach-pump.

In such a state, too, we should daily examine the pubic region. Now and then we are painfully reminded of the negligence of those in close attention upon the patient, by discovering, after death, the bladder distended almost to the umbilicus, and with its attenuated coats inflamed and softened.

Pulmonary Symptoms.—Bearing in mind the frequency of pulmonary complications, we should carefully regard the breathing, and occasionally examine the chest. If pain and crepitation be developed in any part of the chest, a blister should be applied and mercurial infrictions used. Cough and bronchial dyspnœa may be treated with ipecacuanha and senega and the application of mustard poultices and turpentine stupes.

Food.—While we are thus combating the disease, the most unwearied attention must be given to the support of the patient. The blood impoverishes, and the body emaciates very rapidly, and our endeavour must be to introduce such food into the stomach as will be most easily digested. All nourishment must be given in a fluid or pultaceous form. Eggs, milk, vermicelli, arrowroot, or ground rice, beef-tea, gelatin—alone, or in various combinations—will be the most

appropriate articles of diet. The eggs must be given in the form o emulsion in a little wine whey, tea, or cocoa. Two or three shoul be given daily. Milk-arrowroot, containing a little brandy, is a ver appropriate nutriment. The beef-tea may be thickened with well stewed vermicelli, or isinglass. Small quantities of food should b given at a time, and repeated every one or two hours.

Stimulants, in any considerable quantity, are not needed in th early period of the disease. When required they should be give well diluted. A few ounces of wine in the form of wine whey, or dr port mixed with an equal quantity of water, may be given with little sponge-cake at intervals. Effervescent wines must of course b avoided. If the heart's action be weak, or the patient tends to laps into the typhous state, brandy may be freely given, carefully avoidin excess. The following general rules may be observed in the administration of alcoholic stimulants in this disease. As long as th pulse remains under 120 and retains moderate force, six to eight ounce of wine, or four ounces of brandy, given within twenty-four hours will be sufficient. When the pulse ranges between 120 and 130, and is small, we may double these quantities; and if the heart does not respond to the stimulant after twelve hours, thrice the original amount may be given. The bulk and force of the pulse must be our chief guides, and if these notably fail from day to day, we must daily increase the quantity of the stimulant until the patient is supplied wit as much as half an ounce every half hour, always diluted with a littl milk, tea, water, &c. When there is much hectic, and the pulse i small and sharp, strong stimulants often appear to increase the irritability of the system, and in such a case we should give them sparingly and in the early part of the day, trusting to a dose of quinine, with or without opium, according to circumstances, in the evening.

Excepting a little custard, solid food of all kind must be absolutely avoided, until a week after the diarrhœa has ceased, and the stools become solid. Then we may venture to order boiled fish with bread. A boiled egg, a little fish, or a ripe pear or plum, taken too early, will almost certainly bring back the diarrhœa with a complete relapse.

The patient must return very gradually to ordinary diet, and he should be directed to eat slowly and masticate the food thoroughly. At first boiled rice should be taken in place of potatoes.

Convalescence is sometimes very slow, and often retarded by the occasional recurrence of diarrhœa. The styptic should be continued a week after the stools have become solid. At first the bowels are usually constipated, and this condition we shall do well to maintain for days. Subsequently, it will be advisable to relieve the bowels occasionally by a dose of castor oil.

As soon as the digestive function is restored, we prescribe cod-liver oil as a supplement to the diet, in all cases where there is much emaciation, and if, as is rarely the case, the oil does not digest, we may direct it to be rubbed into the abdomen.

PROPHYLAXIS.—Sufficient evidence has been adduced to prove that Enteric Fever commonly arises from the retention of refuse animal and vegetable substances within an undrained, or imperfectly drained soil. If, therefore, the contamination of the soil be prevented by the construction of sufficiently inclined sewers with impermeable walls, and the inhabitants be provided with abundance of pure water, Enteric Fever may be expected to disappear almost entirely.

The requirements for the prevention of the disease are sufficiently simple, but they are not easily fulfilled in every place where living beings are congregated. Nature, indeed, has provided these sanitary conditions almost everywhere, and if man would be more mindful of them his life would be rarely sacrificed to Enteric Fever. A house built upon a hill-side, with its spring of pure water above the foundation, and its cesspool below it, would be free from this disease, as far as external conditions are concerned. But reverse the position of the cesspool and the spring, and the disease may appear at any time.

If the dwelling be built upon a low-lying flat, and there is no near spring or flowing stream, these two necessaries—a pump and a cesspool—must needs co-exist side by side. In such a case they should be as widely separated as possible, and the sides of the well should be thickly covered with concrete. Whenever the premises are small, and it can be so contrived, a water-closet should be provided, and the excretions carried in an impermeable drain to a distance from the pump. In towns and large villages both pumps and cesspools should be abolished, and every house provided with a water-closet in communication with a sewer. The water should be derived from a distant elevated spring or reservoir, preserved from contamination at its source, and conveyed in well-joined iron pipes to its destination. The soil should be well drained, and during the continuance of dry weather the drains and sewers should be regularly flushed.

We cannot positively say that Enteric Fever arises from the ingestion of diseased meat, but there is a strong probability that it does sometimes originate in this cause. Whether this cause has been in operation during the present year when "contagious typhus" has been so generally prevalent amongst, and destructive of our horned cattle, there is no direct evidence to show; but it is remarkable that, coincidentally with the spread of the cattle disease, there has been a great increase of Enteric Fever. On turning to the Table at p. 613, it will appear that the number of cases admitted into the London Fever Hospital in 1865 is more than double that of every preceding year, and more than treble that of the majority. The only effectual way of preventing the admission of diseased meat into the markets would be to establish a limited number of slaughter-houses, where the animals, previous to being slaughtered and afterwards, could be inspected by proper officers. The experience of the present severe epidemic of cattle disease has taught us, that, *after death*, it is exceedingly difficult and, to an inexperienced eye, impossible, to distinguish positively between the flesh of an animal which has died

of contagious fever, and that of one slaughtered in perfect health. In the absence of that more general protection which is so urgently required, two precautions should be taken: first, flesh of a flabby consistence and of a dusky, dead hue should be avoided; and secondly, all meat should be so thoroughly cooked that the fibre is quite firm and free from juice, which, on exposure to the air, becomes red. In the treatment of the contagious variety of the disease, the ordinary precautions against contagion must be taken, viz. the isolation of the patient and the disinfection of everything that has had contact with him.

THE

PATHOLOGY OF SCARLATINA,

AND THE RELATION BETWEEN

ENTERIC AND SCARLET FEVERS.

BY

JOHN HARLEY, M.D. Lond.,

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The pathology of scarlatina is so neglected a subject that no connected account of it exists in medical literature. The opinion of modern writers appears to be that the morbid anatomy of scarlatina is that common to febrile diseases. Here and there a statement with regard to a particular organ or condition may be found; but some of these statements, as may be inferred from the sequel, are not in accordance with the facts herein narrated. I propose, therefore, to give, in the first place, a description of the morbid appearances which I have observed in forty cases of scarlet fever. Of these I find that twenty-eight will be sufficient to illustrate the subject. The date of death is the only circumstance which has influenced me in the selection of these cases, my desire being to give a consecutive history

of the progress of the morbid changes from day to day. The most fatal period is from the third to the sixth day, and I have thought it desirable to use repetition in cases of death during this interval. The remaining cases, which are not recorded in this communication, agree in every particular with those adduced.

I know of no disease in which the morbid effects are more uniform, and I can truly say of all my cases "ex uno disce omnes," so invariable are the essential lesions. As will be seen from the sequel, scarlatina is essentially a disease of the lymphatic system; it is attended with inflammatory action of this system of glands, in which I include the spleen, the mesenteric glands, the tonsils, and the solitary and agminated glands of the intestines; and the essential lesions of scarlatina are those which result from this inflammatory action. Other, and it may be secondary lesions have reference to the condition of the blood and the bile.

The second part of this communication contains a record of those cases in which I have observed the primary inflammation of the intestinal, and sometimes of the other glands, pass into the ulcerative stage, and so lead to the development of enteric fever as a sequel to scarlatina.

It is to this first part of my subject, viz., the pathology of scarlet fever, that I first solicit attention. The facts are included in Cases 1 to 28, and only the necessary details are given.

Case 1. *Death on the third day of scarlatina; general inflammation of the mesenteric and Peyerian glands; psorentery.* —Elizabeth P—, æt. 22, died of delirium and diarrhœa. The scarlet rash appeared on the second day, and was copious and livid; the throat affection was severe, and the glandulæ concatenatæ of the neck swollen. A sister was ill of scarlatina at the same time, and recovered. The post-mortem examination was made a few hours after death. The right cavities of the heart were distended partly with dark fluid blood (temperature 98° Fahr.), but chiefly with large, firm, adherent, and entangled colourless clots, which passed into

the pulmonary artery and superior cava, and branched for a considerable distance within them, nearly obliterating their channels. The left ventricle contained a similar clot of moderate size, entangled with, and adherent to, the cordæ tendineæ. It was continued into the aorta, and branched into the arteries of the arch. The spleen and mesenteric glands were swollen and dark coloured. The agminated glands, as high as the duodenum, were swollen and purple; two of the larger patches, about eighteen inches from the valve, were much raised, of a blood-red colour, and appeared to be abraded. The solitary glands were swollen, prominent, and of a yellowish colour, so that the lower third of the ileum appeared as if uniformly sprinkled with grains of sago. "Psorenterie" is the term used by French writers to denote this condition. The mucous membrane of the small intestine was completely injected, and of a bright rose colour.

Case 2. *Death on the third day of scarlatina; general inflammation of the mesenteric and intestinal glands.*— Caroline D—, æt. 6, sister to H. D— (see Case 7), died comatose. The body was well nourished, and blotched with a scarlet rash. The glands of the neck were a little swollen. Excepting the apex, the right lung was increpitant, fleshy, flabby, friable, and bound to the chest wall by old adhesions. The heart contained only soft blood clots; the gall-bladder was full of thick dark sap-green bile, neutral, sp. gr. 1032, giving with Pettenkofer's test a rich and permanent purple. 1000-gr. measures yielded, at 212° Fahr., eighty grains of almost black brittle extract of strong fatty odour. Spleen three and three quarter ounces, firm. Mesenteric glands swollen to the size of marbles, and making a heavy lobulated mass of the mesentery. The small intestine was in the same condition as that of her sister (Case 7), the agminated glands being vividly injected, and swollen from the jejunum downwards, and there was general psorentery. The mucous membrane of the colon was of a pale rose colour, and the solitary glandulæ, from the cæcum to the left bend of the colon, were enlarged, red, and prominent.

Case 3. *Death on the fourth day of scarlatina; general inflammation of the mesenteric and Peyerian glands; psorentery.*—Emily H—, æt. 11, died comatose. There was diarrhœa on the second day. Glands of the neck enlarged. The right cavities of the heart, and the large vessels connected therewith, blocked with firm yellow clots, as in the preceding case. The gall-bladder full of pale, watery, orange-tinted bile. The spleen and mesenteric glands moderately swollen; some of the latter purple. The blood-vessels of the lower third of the ileum were completely injected, and the agminated glands of this portion of the bowel swollen and inflamed, those near the valve being furnished with cockscomb-like processes. The solitary glands were all swollen, forming white hardish eminences about the size of hemp-seeds; general psorentery.

Case 4. *Death on the fourth day of scarlatina; general inflammation of the mesenteric and Peyerian glands; psorentery.*—John F—, æt. 5, died rather unexpectedly of oppressed breathing and failure of the heart's action. Autopsy three hours and a half after death. Skin discoloured with fine and coarse dark purple spots, almost confluent in the groins and on the sides of the body. Temperature, under the liver, 100·9° F. The right cavities of the heart contained colourless entangled clots branching into the lungs and neck. Bile abundant, watery, of a greenish-yellow tint. Spleen three ounces and a half. The mesenteric glands, and the agminated glands of the ileum, from the jejunum downwards, were purple and swollen; the solitary glands in the condition of general psorentery, and rough to the touch. The solitary glands of the large intestine were swollen and purple.

Case 5. *Death on the fourth day of scarlatina; general inflammation of the mesenteric and Peyerian glands; psorentery.*—George B—, æt. 30, died delirious and prostrate; the body was fairly developed; the skin mottled with a lobster-red, becoming purple about the shoulders, and on the sides of the chest and loins. Heart-clots as in the previous case.

Gall-bladder collapsed, pale, and contained only a drachm of clear, watery, orange-coloured, non-alkaline bile. Spleen turgid and enlarged. Mesenteric glands turgid, many as large as French beans, generally pale. The lower part of the ileum was purple externally, pale internally. All the Peyerian glands were pale, swollen, abruptly prominent, and spongy-looking, and the whole of the solitary glands greatly enlarged, and in the condition described in the former case.

Case 6. *Death on the fourth day of scarlatina; general inflammation of the mesenteric and intestinal glands; moderate psorentery.*—Charles S—, æt. 10½, died of exhaustion on the fourth day of very severe scarlatina. The rash was very intense, the whole skin being of a fiery damask-red colour. The body was well nourished, and the skin discoloured with fine purple spots and blotches. The heart was not examined; the kidneys were congested; the gall-bladder contained two ounces and a quarter of dark greenish-brown bile, very slightly ropy, neutral; sp. gr. 1013·2, giving a reddish-purple colour with Pettenkofer's test 1000 grain measure yielded, at 212° Fahr., 36·4 grains of dark greenish-brown extract. Spleen four ounces and a half, almost as firm as liver. The mesenteric glands were turgid and purple, or pale, and greatly enlarged, so as to convert the mesentery into a large thickened lobulated mass, some of the glands being as large as a pigeon's egg. The lower portion of the ileum was purple, and Peyer's patches in the last six inches were greatly swollen and injected, forming cocks-comb-like folds; above this they were merely swollen and spongy, as in the first stage of enteric fever. Besides this there was general psorentery, but the glands were not so much swollen as in the preceding two cases. The cæcum was severely congested, and the solitary glands of the colon were swollen and prominent, a portion being of a purple colour.

Case 7.—*Death on the fourth day of scarlatina; general*

and severe inflammation of the mesenteric and intestinal glands.—Henrietta D—, æt. 8, sister to C. D. (see Case 2), died of failure of the heart's action. The dead body was covered with a livid scarlet rash, and the glands of the neck were slightly swollen. The right cavities of the heart contained entangled, colourless, and soft dark clots. The bile was abundant, and had the same characters as that of her sister (see Case 2). The spleen weighed three ounces, and had a depressed white cicatrix, the size of a sixpence, on the centre of the outer surface. The mesenteric glands were much swollen, round, and purple, and the whole mesentery was completely injected, purple, and so greatly thickened as to resemble a large half-filled bag of large and small marbles. The intestines were empty; the mucous membrane of the lower third of the ileum was deeply injected, and covered with a dusky green adherent slimy ooze. The agminated and solitary glands throughout were greatly inflamed and swollen, of a purple-rose or deep claret colour, always darker than the surrounding mucous membrane, above which they were elevated one sixth of an inch. Those nearest the valve were most severely affected. The ascending and transverse portions of the colon were injected, and the glandulæ swollen and more deeply injected.

Case 8.—*Death on the fifth day of scarlatina; general inflammation of the mesenteric and intestinal glands, with psorentery.*—Rosa B—, æt. 2½, died of failure of the heart's action, with large buboes on either side of the neck. The dead body was covered with a dusky scarlet rash; the right cavities of the heart were distended with soft, chiefly colourless clots, which were continued into the larger vessels and their primary branches. The gall-bladder was full of greenish, watery bile. The spleen weighed two ounces and a half, and was of a firm consistence. The mesenteric glands in connection both with the large and small intestine were much swollen, some of those about the junction of the two tubes being as large as walnuts. The whole of the glands of the small intestine, from the jejunum downwards, were swollen

and prominent, the solitary glands being in the state of general psorentery (as in Case 1), giving the mucous membrane a roughly granular feeling; some of the latter were beginning to soften at the summits, and presented an abraded appearance. The agminated glands were much injected and angry looking, being raised the eighth of an inch above the pale mucous membrane surrounding them. One patch, a foot from the valve, was in a more advanced stage, and almost bleeding. The appearance of the open intestine was striking, the mucous membrane generally being everywhere naturally pale, and so bringing the red raised Peyer's patches into strong relief, and the intervals between these in the last three feet of the bowel being thickly strewn with the prominent straw-coloured solitary glandulæ.

Case 9.—*Death on the fifth day of scarlatina; general but moderate inflammatory swelling of the mesenteric and intestinal glands.*—Walter N—, æt. 17, died delirious and prostrate. The body was well developed but spare, and the cutaneous affection had been so severe that the epidermis was abraded from the scrotum, elbows, and nates. The gall-bladder was full of ropy greenish-brown bile, muddy from epithelial *débris*. On standing it became clear, and of a pale glaucous colour, like some specimens of urine. It was neutral, of sp. gr. 1013·2. Pettenkofer's test gave the faintest brownish-purple tinge, which did not interfere with the transparency of the mixture and soon disappeared. 1000-grain measures yielded by the water-bath 31·2 grains of brittle residue of fatty odour and dingy gamboge colour. The spleen weighed twelve ounces; it was palish-purple, firm, and turgid. The mesenteric glands and mesentery generally were greatly congested, the glands being enlarged, spherical, and purple. The transverse colon contained healthy-looking fæces nearly formed; a few of its solitary glands were enlarged, and some of them purple. The mucous membrane of the ileum, excepting the last four inches, was of an uniformly dusky purple colour. There was general psorentery. Peyer's patches partook of the general and severe congestion, and were

slightly swollen. Those of the last four inches of the bowel were pale, like the mucous membrane.

Case 10.—*Death on the fifth day of scarlatina; general inflammation of the mesenteric and ileal glands.*—Joseph S—, æt. 45, died of exhaustion. The body was finely developed, and the skin discoloured with dusky purple blotches and spots. The gall bladder was empty and contracted, the mucous lining injected and red, and moistened with a few drops of colourless, alkaline, mucous fluid. The spleen seven ounces, and soft. The mesenteric glands purple, turgid, and as large as filberts. The bowel contained a little light ochre-coloured fluffy fæcal matter. The ileum was purplish externally and pale internally. The solitary glandulæ were in the state of general psorentery. Peyer's patches were not so much affected, being pale and only a little more prominent than in health, excepting, however, three within two feet from the valve, which were considerably raised and injected.

Case 11.—*Death on the sixth day of scarlatina; general inflammation of the mesenteric and ileal glands.*—William S—, æt. 4, died from progressive failure of the heart's action. The abdomen was tympanitic before death. The body was well nourished. The right heart contained fluid blood and very firm colourless clots branching away into the great vessels. The gall bladder contained half an ounce of watery fluid, turbid from epithelial *débris*. On standing it had the appearance of pale urine. The spleen was swollen; the mesenteric glands large, turgid, and purple; the intestines were distended with air, and empty of solid matters. In the ileum there was general psorentery, and Peyer's patches were red and swollen, many raised the one eighth of an inch above the mucous membrane, with the paleness of which they were in strong contrast.

Case 12.—*Scarlatina; death on the sixth day; severe inflammation of the mesenteric and ileal glands.*—William

C—, æt. 19, was admitted on the fourth day of a very severe attack. The rash was abundant and dusky; pulse 124, and very weak; tongue dry and brown; the throat affection moderate, and the glands of the neck only slightly swollen, and there was delirium. The skin was discoloured by a raddle-coloured patchy rash. The veins of the heart were enormously congested with very dark blood, and the *left* auricle was distended with equally dark, softly clotted blood. The left lung was collapsed, and adherent by old membranes to all parts of the chest walls. The right lung was congested; the kidneys were healthy; the spleen weighed ten ounces and a half; it was pale, and of natural consistence. The mesenteric glands were greatly enlarged, some the size of pigeons' eggs, and purple. The intestines were injected, Peyer's patches were very vascular, the turgid vessels having a whipcord appearance; the ridges were greatly swollen, producing a deep alveolation, and some ridges were raised into red tongues a quarter of an inch in length. This was the condition throughout the lower third of the ileum. A few of the solitary glands were swollen, and two of them formed bright damask-red, angry-looking elevations. The large intestine was healthy.

Case 13. *Death on the seventh day of puerperal scarlatina; general inflammation of the mesenteric and ileal glands.*—Sarah L—, æt. 18, died the eighth day after delivery of a healthy child. Death was preceded by delirium, slight strabismus, scanty and fœtid lochial discharge. The uterus weighed twenty ounces; the cavity was filled with viscid blood clot and a small portion of firmly adherent placenta. It exhaled a fœtid odour. The mesenteric glands were slightly swollen. The intestines contained a moderate quantity of natural fæcal matter. The mucous membrane of the ileum was pale. Peyer's patches throughout were raised above the level of the mucous membrane, their ridges were elevated and swollen, so as to give them a spongy appearance; those about the middle of the bowel were injected. The solitary

glands were more considerably swollen and many of them congested.

Case 14. *Death on the eighth day of scarlatina; severe inflammation of the mesenteric and ileal glands.*—Francis S—, æt. 17, died in a typhous condition. The body was finely developed, the skin discoloured with a livid scarlet rash, and the epidermis separated from the parts exposed to friction, and in other parts raised into minute vesicles containing milky serum. The lungs were deeply congested, and there were points of ecchymosis on the pleural surface. Patches of ecchymosis were also present on the parietal pericardium. The right heart was enormously distended with colourless clots which branched far away into the lungs and neck. The gall-bladder was full of healthy-looking but watery bile. The spleen weighed twelve ounces, and was dark and soft. The mesenteric glands were swollen, turgid, and purple. The ileum contained some fluid, shining, dark-green, fæcal matter. The lower portion was severely congested, and there was general psorentery, and inflammatory swelling of all the Peyerian glands, some of which were prominent and almost bleeding.

Case 15. *Death on the ninth day of scarlatina; general inflammation of the mesentery and glands of the ileum.*—Mary ——, æt. 2, died of severe glandular and cellular inflammation of the neck. For some days before death deglutition was impossible from swelling of the tonsils and fauces. The deeper cervical glands and the left tonsil were in a state of suppuration; the follicular glands at the base of the tongue swollen. The spleen weighed two ounces and three quarters. The gall-bladder was injected and of a rosy tint; it contained half an ounce of watery fluid, resembling pale urine in appearance. The mesentery was everywhere greatly thickened and purple from the presence of dark, turgid, spherical glands, the average size of which was that of a hazel nut. The intestine contained some fluid fæcal matter of an ochre colour; the lower portion of the ileum

was injected and purple. Peyer's patches were all swollen and prominent; those in the upper part of the bowel, white and opaque, the inter-follicular ridges for the most part in contact and overlapping the follicles, as in the first stage of enteric fever, those in the lower portion of the ileum were beautifully injected, purple, and raised about the one eighth of an inch above the pale mucous membrane surrounding them. Just above the valve the injection was more vivid, and many of the solitary glands were swollen and ecchymosed. The large intestine was quite healthy.

Case 16. *Death on the tenth day of scarlatina; general and severe inflammation of the mesenteric and intestinal glands.*—Jane Bradbrooke, æt. 1½, died of exhaustion with a huge bubo on either side of the neck. The body was mottled with a dusky scarlet rash. The heart was free from clots. The liver pale, 18½ ounces; the gall-bladder contained half an ounce of clear, watery fluid of the colour of pale urine; on a white plate it had a bright yellow tinge. Pettenkofer's test thrice applied and compared with similar testings of other bile, gave not the slightest colour reaction. 1000 grain measures yielded at 212° Fahr. 11·1 grains of brittle, bright, gamboge-yellow extract, destitute of fatty odour. The spleen weighed 3¼ ounces, and was turgid, firm, and of a dark liver colour. The whole of the mesenteric glands were greatly enlarged, being of the size of ordinary marbles, round, turgid, and purple. The intestines contained slimy mucus and one or two sulphur-coloured pellets of fæcal matter. In the ileum there was general and severe psorentery, the glandulæ in the lower part being mostly white, and some of them twice and thrice the size of hemp-seeds. All the agminated glands were red, swollen, and elevated above the surrounding pale mucous membrane. This condition was as marked in the higher as in the lower parts of the ileum. A patch at the distance of four feet from the valve was abraded. The mucous membrane of the larger intestine was injected, and pink, and the solitary glands enlarged and congested.

Case 17. *Death on the eleventh day of scarlatina; general inflammation of the mesentery and intestinal glands.*—John R—, æt. 13, died of exhaustion. The body was somewhat emaciated; the cervical glands swollen; the abdomen tympanitic. The gall-bladder was distended with clear watery fluid of the appearance of deep golden sherry by transmitted light, of an orange-yellow colour by reflected light; reaction decidedly alkaline; Pettenkofer's test gave only a faint, dull, purple colour; sp. gr. 1014; 1000 grain measures yielded 34·8 grains of brittle, deep-orange coloured extract. The spleen and mesenteric glands were swollen. The bowel contained some light ochre-coloured fæcal matter. The Peyerian glands at and just above the valve were swollen, wrinkled, and pale; the rest were injected and slightly swollen, the mucous membrane being generally pale; the solitary glands were equally swollen. There was a bloody ooze upon the mucous membrane of the middle of the ileum for the space of nine inches. The solitary glandulæ of the colon were red and moderately swollen.

Case 18. *Death on the twelfth day of scarlatina; general inflammation of the mesenteric and ileal glands.*—Jane A—, æt. 3, died from failure of the heart's action. The rash was livid on the eleventh day, and the glands on both sides of the neck were considerably swollen. The right heart and its large vessels contained colourless clots as in the other cases. The spleen was turgid. The mesentery was purple and greatly thickened from swelling and congestion of its contained glands. In the ileum there was general and severe psorentery and every Peyerian gland was dark-red and swollen; many being raised one eighth of an inch above the pale mucous membrane surrounding them. The large intestine was healthy.

Case 19. *Death on the thirteenth day of scarlatina; acute desquamation of the mucous membrane of the large intestine, with bloody exudation and general inflammation of the mesenteric and intestinal glands.*—Mary G—, æt. 4, died of sloughing of the left tonsil and ulcerative destruction of

the left pillars of the fauces, severe glandular inflammation on both sides of the neck, and hæmorrhage from the bowels from the eleventh to the thirteenth day. The body was well nourished; the sides of the neck occupied by large buboes. The mesenteric glands were greatly swollen; the spleen turgid; the agminated and solitary gland of the lower third of the ileum were injected and raised above the level of the surrounding mucous membrane. The large intestine contained a brownish-red, grumous fluid, and, excepting the first six inches of the ascending colon, the whole bowel from the orifice of the vermiform appendix to the rectum was greatly thickened by the formation of a bright-red villous exudation. Scarcely any portion of the mucous membrane presented a natural aspect. Lining the cæcum as far as the valve, the bloody membrane thinned away and left the next six inches of the mucous membrane of the colon bare; it then commenced again as a more wrinkled thickening of the injected mucous membrane, and increasing in development upwards attained its greatest thickness (the quarter of an inch) in the transverse and descending portions of the colon, thinning away again towards the rectum which was also lined with it. The membrane was readily detached by the edge of a knife, and the exposed surface of the bowel was then seen to be blotched and spotted with ecchymosis. The spots were circular and very numerous; some were mere points, but many were one quarter of an inch wide; all were raised and had a central depression. They were, in fact, the swollen and bleeding solitary glandulæ, and it was thus evident that these were the foci of the severe inflammatory action which had resulted in the above described exudation. This formed a thick compact membrane, for the most part blood-stained, and so wrinkled by the contractions of the bowel that its processes strongly resembled a cockscomb. It was composed of much molecular matter (coagulated fibrin), blood-corpuscles, a great quantity of well-formed columnar epithelium, numerous dark granular corpuscles varying in size from a blood-corpuscle to the $\frac{1}{1200}$ of an inch, and a few cells of squamous epithelium. In a word, the con-

stituents were those of acute desquamative colitis with exuded blood, a pathological condition completely agreeing with that which so frequently affects the kidneys in this disease.

Case 20. *Death on the fifteenth day of scarlatina; moderate inflammation of the mesenteric and ileal glands.*—Isabella L—, æt. 12, died of diffuse suppuration of the glands and connective tissue of the neck, and purulent arthritis of the wrist, ankle, and shoulder, which came on the day before death. The mesentery was injected and the glands swollen. There was general but moderate psorentery, and Peyer's patches were injected and raised about one tenth of an inch above the paler mucous membrane. The large intestine was healthy.

Case 21.—The brother of Charlotte B— (Case 25), a child æt. 4, was taken ill of a severe attack of scarlatina three days before his sister was affected and died on the fifteenth day. He, too, had complications of the lung, bowel and kidneys, and there was active pulmonary congestion, albuminuria, and towards the close, diarrhœa. The kidneys together weighed 12½ ounces. There was also no affection of the solitary glands, but swelling and injection of the mesenteric and Peyerian glands.

Case 22. *Scarlatina; death on the seventeenth day; purulent infiltration of the areolar tissue of the neck; inflammation of the mesenteric glands.*—Sarah W—, æt. 4, was admitted with a very severe attack. The rash was patchy and dusky, a sero-purulent fluid flowed from the nose and eye; there were large glandular swellings on both sides of the neck. The tongue was dry and the pulse small. She died of failure of the heart's action. The right side of the neck was raised to the level of the ramus of the jaw by a thick brawny swelling, and the deeper portion of the connective tissue was infiltrated with pus; the glands being in the same condition as in Case 23. The mesenteric glands

were as large as marbles, turgid and purple. The spleen weighed 4 ounces, it was firm and of a dark colour. The intestines were pale, and the solitary and agminated glands also pale and only very slightly raised. There was a mass of stone-coloured, soft, unhealthy fæces in the descending colon. The liver weighed 21 ounces; the gall-bladder was distended with clear, pale orange-coloured, ropy bile. The kidneys were pale, and weighed 7½ ounces. The lungs were adherent, but free from traces of recent inflammation. The heart and great vessels were obstructed by colourless clots.

Case 23. *Scarlatina; death on the twentieth day; purulent arthritis and nephritis; general inflammation of the mesenteric and intestinal glands.*—Helen G—, æt. 6, admitted on the third day of a severe attack of scarlatina, with a vivid rash. Pulse 120; dry tongue, and glandular swellings on each side of the neck. On the fifteenth day there was slight albuminuria and swelling with great tenderness of the left ankle and knee and the right elbow, together with purulent infiltration of the connective tissue of the neck. Henceforward she gradually sank. The glands of the neck were as large as walnuts, some pale others purple, some with softened centres and all imbedded in a purulent connective tissue. The joints above mentioned were full of yellow pus, and the glands of the popliteal space were purple and turgid, and surrounded by purulent tissue as in the neck. The tonsils and solitary glands of the tongue were purple and greatly swollen. The mesentery was greatly enlarged, as in Case 6, and many of the glands were as large as pigeons' eggs and purple, standing out on each side of the mesentery. In the ileum there was general psorentery and the agminated glands were all prominent, and swollen as in the early stage of enteric fever. Many of them were deeply injected at the centre; the mucous membrane of the ileum was pale. The solitary glands of the large intestine were so swollen and prominent as to be readily felt on passing the finger over the surface of the bowel. The spleen weighed 5¼ ounces; it was turgid and friable. The liver 35½ ounces.

The gall-bladder was full, containing about 3 drachms of clear watery bile of the colour of dark sherry. As it flowed along a white porcelain plate, it left a deep gamboge track. Pettenkofer's test produced a good purple tinge, but the mixture had very little depth of colour. All the cavities of the heart contained white gelatinous breaking-down clots which extended far into the great vessels, and fluid chocolate-coloured blood. There was no trace of inflammatory action in the lungs. The kidneys weighed together 10 ounces, they were highly congested and the cortex was studded with bright blood points.

Case 24. *Death on the twenty-fourth day of scarlatina; inflammatory swelling of a portion of the mesenteric and ileal glands.*—Mary V—, æt. 5, died exhausted with glandular swelling and diffuse cellulitis of the neck, and profuse fœtid discharges from the nostrils and an ear. The kidneys were quite healthy, weighing together 5½ ounces. The liver was enlarged and fatty, weighing 27 ounces. The gall-bladder full of green ropy bile. The spleen weighed 4½ ounces, and was naturally firm. The mesenteric glands about the lower end of the ileum were swollen and purple. The intestines contained some pellets of natural fæces. The agminated glands of the ileum were all prominent. One of the largest of them, about a foot from the valve, was uniformly injected; others above and below partially so, and contrasted strongly with the paleness of the surrounding mucous membrane. There was no ulceration of the swollen glands, but the interfollicular ridges were vividly injected, and the turgid vessels appeared bare. The valve itself was pale but as usual thickened by the swollen glands. The large intestine was healthy throughout.

Case 25. *Scarlatina; death on the twenty-ninth day; diarrhœa from the eleventh to the twenty-ninth day; limited pleuro-pneumonia on the seventeenth day; albuminuria on the twenty-third day; ascites and slight œdema of some parts of the areolar tissue on the twenty-seventh day; general inflam-*

mation of the mesenteric and Peyerian glands.—Charlotte B—, æt. 5, was admitted on the second day of a severe attack of scarlatina. The rash was vivid on the fourth day, and there was glandular swelling of both sides of the neck. Pulse 120. On the eleventh day the rash had nearly disappeared, the glandular swellings were larger, pulse 124, and the bowels became loose, having previously acted rather freely. On the fourteenth day the bowels were very loose, and the abdomen distended; the angles of the mouth excoriated. The diarrhœa continued profuse, and the stools were light ochre coloured and flocculent. On the seventeenth day there was a short dry cough, the respirations were 50, the pulse 124; considerable elevation of temperature, and fine crepitation at the back of the left lung. She continued to have two or three loose stools a day; the pneumonic symptoms increased in intensity, the respirations being 64 and the pulse 130 to 140 on the twenty-seventh day, when the face became a little puffy, and the albumen of the urine increased. Death was preceded by a fluttering pulse and great orthopnœa. The diarrhœa continued unchecked. The body was well nourished, the face, ankle, and labiæ slightly œdematous, the skin desquamating, and slight glandular enlargement of the neck. There was half a pint of clear serum in the pleural cavities and about a pint in the abdominal cavity. The kidneys were pale and enlarged, weighing together 11½ ounces, the cortical portion severely congested. The heart contained the usual firm entangled clots, branching for a considerable distance into the great vessels. The upper lobe of the left lung was covered with a layer of recent lymph, and it was in a state of simple pneumonic hepatization. The liver was severely congested and weighed 37½ ounces; the bile was pale and watery; the spleen three ounces, firm; the mesenteric glands greatly enlarged, turgid and spherical; those about the junction of the intestines as large as a pigeon's egg. The whole mesentery formed a heavy lobulated mass. The intestines contained a small quantity of bright orange-coloured flocculent fæcal matter. The small intestine was pink from vascular injection, and the mucous membrane was covered with a thick adherent

layer of opaque white mucus. Some parts of the mucous membrane were vividly injected. Peyer's patches alone were much swollen, and for the most part pale. Some of the inter-follicular ridges were one eighth of an inch wide. One of the smaller glands appeared as if cicatrized at the centre.

Case 26. *Death on the thirty-third day from the accession of scarlatina; swelling of the spleen and mesenteric glands, &c.*—Fanny L—, æt. 19, died of rheumatic fever and pericarditis, which supervened during convalescence from scarlatina. There was extreme orthopnœa during the two days preceding death. The pericardium was completely adherent. The heart greatly enlarged, weighing 16 ounces alone. There were large fibrinous clots in both ventricles, and a firm black clot in the right auricle. Kidneys slightly enlarged and fatty. The spleen weighed 10 ounces. The mesenteric glands were about twice their natural size and rather flabby. The intestinal glandulæ healthy.

Case 27. *Death on the forty-first day from the accession of scarlatina; persistent enlargement of the spleen and mesenteric glands; disease of the kidneys.*—Harriet P—, æt. 17, died of exhaustion with albuminuria after a very severe attack of scarlet fever, during which, from the tenth to the fifteenth day, there had been diarrhœa. The liver was pale and fatty; the bile normal. The kidneys enlarged and pale, the right weighed 7½ ounces, the left 7 ounces. The spleen weighed 10 ounces. The mesenteric glands were considerably enlarged, rose-coloured above, purple near the cæcum. The lower end of the ileum was injected and purple; a spot of ecchymosis in the mucous membrane existed just above the valve. The intestinal glands were healthy. The mucous membrane of the cæcum was injected.

Case 28. *Death on the sixty-ninth day from the accession of scarlatina; slight tumidity of the mesenteric glands and Peyer's patches, congestion of the cæcum, disease of the kidneys.*—Harriet B—, æt. 19, died of pulmonary embolism and

albuminuria. The right cavities of the heart and the pulmonary artery and its branches were obstructed by a firm white clot; there was limited pericarditis. Liver fatty, 54 ounces; gall-bladder contained an ounce of healthy bile. Kidneys large, severely congested and the tubes stuffed with epithelial débris; the right weighed 10 ounces, the left 8½. Spleen 6½ ounces, normal in appearance. There was slight tumidity of the mesenteric glands and of Peyer's patches in the neighbourhood of the ileo-cæcal valve. The cæcum was severely congested, and there was extravasation of blood into the submucous tissue.

Upon analysis of the foregoing twenty-eight cases, it appears that the greater number died on days ranging consecutively from the third to the fifteenth day, and that the remainder died on the seventeenth, twentieth, twenty-ninth, thirty-third, forty-first and sixty-ninth days. More or less albuminoid or fatty degeneration of the kidneys existed in six cases, and in these death occurred on the fifteenth, seventeenth, twentieth, twenty-ninth, forty-first, and sixty-ninth days respectively. In the rest these organs were healthy. The pathological changes common, with a few exceptions (depending upon the time of the disease), to all, are as follows:

1. *The formation of fibrinous clots in the heart and great vessels during a pyrexial state, at any period of the disease.* —This is the commonest cause of death during the early stage of scarlatina, it is indicated during life by the reduction often sudden, of a full pulse of about 120, to a dribble of 150 or 160 almost imperceptible impulses. The failure of the heart's action is commonly attended with orthopnœa and delirium from obstruction to the pulmonary and cerebral circulations. On opening the body before it has lost a degree of temperature, and while the hot blood is still fluid, the right heart will be found distended, partly with dark fluid blood which coagulates on exposure; and partly, sometimes chiefly by a large, firm, white, bifid clot continuous through the auriculo-ventricular openings. Each portion is interlaced with, and firmly adherent to the tendinous cords and out-

standing muscular bands of the cavity in which it lies, and sends outwards a rope-like continuation, the one into the pulmonary artery, and the other into the superior cava. These processes not only occupy a large portion of the area of these tubes, but branch with their branches upwards, into the cranial cavity and outwards into the lungs, whence they may often be withdrawn in ramifications up to the eighth degree, and eight or nine inches long.

The left heart was generally empty and firmly contracted ; in one case (1) each cavity was occupied by a large fibrinous clot, that in the ventricle spreading into the brachio-cephalic vessels of the arch of the aorta, and that in the auricle sending large ramifying branches into the pulmonary veins. In another case (12) the auricle was distended with dark softly clotted blood.

In Case 26 there were fibrinous clots on both sides of the heart, but there was pericarditis in this case.

2. *Marked derangement of the hepatic function.*—The bile was examined in twenty cases. In five only were the characters of the secretion normal, and in these cases death occurred on the third, fourth, twenty-fourth, and sixty-ninth days respectively—periods probably too early in the two former cases for the development, and in the two latter too late for the persistence, of any notable derangement of the bile.

In the remaining fifteen cases the bile was in a very deteriorated condition. In two patients (Cases 10 and 15) there were evidences of decided inflammation of the gall-bladder, the viscus being injected and the mucous membrane rose-coloured ; and in one of these cases (10) there was a complete absence of bile, the mucous membrane being merely moistened with a few drops of a colourless alkaline fluid. In three other cases the bile had a natural greenish-brown colour, but it was greatly deficient, like that of the remaining ten cases, in solid matters, the specific gravity in not one of the thirteen cases exceeding 1014, and the amount of solid matter not more than 36·4 grains, in 1000 grain measures of the secretion, being less than one third of the normal amount. In one case (16) 1000 grain measures yielded only 11·1 grains

of solid matter. In the majority of the cases the bile was turbid from epithelial débris, but on settling it became clear and transparent, and resembled pale urine. In all the thirteen cases there was a notable deficiency in the biliary acids; in one case (16) this was complete, and in three others (6, 9, and 17) nearly complete, Pettenkofer's test indicating, upon several trials, a mere trace. The colouring matter was never absent, and the thin bile always left a more or less bright-gamboge-coloured track after flowing over a white surface. The intestinal contents agreed with this condition of the bile. If, as rarely happened, the bowel contained solid fæces, they were in some cases of a pale ochre or sulphur colour. The fæcal matters, however, were generally fluid, grumous, or flocculent, often stringy, and of a pale ochre colour. Such also were the characters of the stools before death in many of the cases.

3. *General inflammation of the lymphatic system of glands.* This, as far as *the ordinary lymphatic glands* are concerned, was usually confined to those of the head and neck; but in two cases (20 and 22) those of the extremities were affected, in connection with suppurative arthritis. The cervical glands were swollen in every case, in some slightly, in several severely; and in the two cases just quoted, to the formation of huge suppurating buboes. The suppurative action, however, affected the connective tissue more than the glands, which were for the most part purple and enlarged to the size of marbles or walnuts, only a few of them, in the worst cases, having softened and purulent centres.

The tonsils and solitary glands of the tongue were generally affected in every case.

The spleen.—Was not noted in one case. In four cases (death at the fourth, fifth, twenty-ninth, and sixty-ninth day) the gland was not enlarged. In the remaining twenty-three cases it was swollen; and in five of these (ninth, twelfth, fourteenth, twenty-fifth, and twenty-sixth) it weighed from ten to twelve ounces. In young children the texture was firm, in adults it was sometimes of normal consistence and sometimes soft.

The mesenteric glands were generally and severely inflamed

in every case, the whole mesentery being thickened, and the glands purple and swollen, in some cases to the size of a pigeon's egg. Even the small glands in the attached borders of the transverse and descending mesocola were often found turgid and purple.

The solitary glands of the ileum were in the condition known as "psorentery," *i. e.* forming white granular or papular, solid-feeling elevations, giving to the mucous membrane the appearance of being thickly sprinkled with grains of sago in fourteen cases. In others the solitary glands were only partially affected, the swelling being usually softer and more diffuse in these cases, and the glandulæ deeply injected, some occasionally had an abraded appearance. In three cases, in which death occurred on the eleventh, seventeenth, and sixty-ninth days, there was only very slight swelling of a few of the glandulæ; and in the four remaining cases in which death happened on the fifteenth, twenty-fourth, twenty-ninth and thirty-third days respectively, these glands were altogether unaffected.

The solitary glands of the large intestine were enlarged and inflamed in Cases 4, 6, 7, 9, 16, 17, 19, and 23. In one of these (19) there was acute desquamation of the mucous membrane of nearly the whole of the large intestine. In another case (28) the cæcum was severely congested. In those of the remaining cases (about one half) in which the large intestine was examined, the mucous membrane and its contained glandulæ were quite healthy.

The agminated glands were more or less swollen and inflamed in every case but one (26), that in which death occurred on the thirty-third day. In Case 22 (death on the seventeenth day, from suppuration of the cellular tissue and glands of the neck) there was only slight swelling. In the other cases the inflammation was decided and in many severe.

The glands were commonly raised one-eighth of an inch above the surrounding mucous membrane, than which they were always more deeply injected, and in the greater number of cases the difference was very striking, the mucous membrane

generally being pale, and the swollen glands of a vivid red or claret colour.

The inflammatory action was usually confined to the glands in the lower third of the ileum, but in four or five cases the whole of the patches from the jejunum downwards were affected. The inter-follicular ridges were often one-eighth of an inch wide, giving to the paler glands a spongy appearance; but the ridges were more often vascular, and fine hairlike turgid vessels were occasionally very conspicuous. In some cases the vascular ridges were prolonged into folds a quarter of an inch in length (see Cases 3, 6, 7, and 12, in which death took place on the fourth and sixth days). In some of the larger glands isolated foci of inflammatory action were occasionally seen and sometimes the whole gland was in an almost bleeding state and appeared softened and abraded.

The general mucous surface of the ileum was severely inflamed in a few of the cases (1, 7, 8, 9, &c.). In some others it was covered over by a thick adhesive layer of opaque white or slimy mucus, the membrane itself being severely injected (see Cases 7 and 25).

If we now take the pathological conditions into one general view it will appear that *febris lymphatica is the appropriate scientific definition of scarlatina;* that death is very likely to occur during the first week of the disease from the formation of fibrinous clots in the heart and great vessels; that the condition of the biliary function is such as to lead to an outbreak of diarrhœa; that mesenteritis, and enteritis sometimes general but usually confined to the solitary and agminated glands, exist from the third day and onwards during an attack of scarlet fever, both being at their acme during the height of the fever, *i. e.* from the third to the seventh day; that the enteritis is usually latent, but ready to declare its presence upon slight provocation; and that this inflammatory condition of the mesenteric and intestinal glands may persist to the sixty-ninth day (see Case 28).

From this view *one general conclusion as to the connection of scarlet fever and enteric fever is inevitable, viz., that the pathological changes accompanying an attack of scarlatina*

include all those of the first stage of enteric fever, and are so far identical with them. And it follows therefore that the transition from the former disease to the latter is nothing more than a natural pathological sequence, readily determined by any cause which may increase the intestinal irritation.

Having arrived at this point of the inquiry, I now proceed to show that this transition is, under circumstances even favorable for its prevention, no uncommon event; that it is often very insidious in its progress, and complete in its results.

Case 29. *Scarlatina; convalescence on the thirteenth day; relapse during sojourn in the hospital with scarlet rash on the twenty-eighth day; fully developed enteric fever on the thirty-second day; convalescence on the fiftieth day.* — George W—, æt. 30, was sent into the London Fever Hospital by a distinguished authority on scarlet and enteric fevers as a case of scarlatina, on the 23rd of July, 1869.

This was the second day of the disease. The rash was well developed and the throat was sore and congested; the pulse was 120. The tongue moist, and its papillæ prominent. The bowels had not been open for two days. He was ordered a dose of house mixture, and chlorine draught.

On the fourth day the rash was still present, the pulse 72. Tongue moist and furred. There was some desire for food, and fish diet was ordered.

On the sixth day the bowels were confined, and two compound rhubarb pills were prescribed.

On the twelfth day the pulse was 60, tongue moist and cleaner, the rash faded and the skin cool and rough, the throat nearly well; the bowels acting naturally.

Next day he was ordered full diet. He continued well, with rather a defective appetite, but regular action of the bowels, up to the twenty-eighth day, when, without any apparent cause, he suffered a severe relapse of pyrexia, pulse 132, with headache, anorexia, vomiting, the eruption of a general scarlet rash, and sore throat with redness and swell-

ing of the fauces. In the evening the pulse was 122, the temperature 103·8°.

Next day 104, temperature 103°; the thirtieth 106 and 105°.

On the thirty-first day 100 and 103·8°; the above-mentioned symptoms continued, the vomiting had not been completely checked, and to-day purging set in, the stools being very frequent, watery and greenish.

On the thirty-second day there were three loose stools, two rose papules on the abdomen, and tenderness and gurgling in the right iliac fossa.

On the thirty-third day there were three watery light coloured stools, and twenty fresh bright rose papules on the abdomen. The vomiting had ceased and the pyrexia had slightly declined.

On the thirty-fourth day, pulse 100, temperature 100·6°, four loose stools, numerous fresh spots, vomited thrice.

On the thirty-fifth day fresh spots continued to appear, and the rash was very bright, diarrhœa moderate, vomiting ceased.

On the thirty-seventh day there was decided improvement; the bowels continued to act three or four times in twenty-four hours, and the stools were characteristic of enteric fever; the abdomen and chest were freely spotted with old and new papules. During the next week the diarrhœa partially declined, convalescence began on the forty-fifth day, and the patient left the hospital well on the sixtieth day. During the latter part of the time he was under Dr. Murchison's care.

Case 30. *Scarlatina; convalescence on the nineteenth day; sojourn in the convalescent ward till the thirty-first day, when there was a relapse of pyrexia; on the next day diarrhœa, and during the following nine days fully developed enteric fever, with some peritonitis; convalescence on the sixty-fourth day.*—Amy A—, æt. 14, was taken ill with rigors, sore throat, and pain in the back, and on the following day the scarlet rash appeared. She was admitted into the London

Fever Hospital on the fourth day, when the pulse was 120, the fauces and tonsils moderately swollen and congested, the conjunctivæ injected, and the body covered with a well-developed scarlet rash.

5th day.—Pulse 130, rash, dark and patchy. From this date the pyrexia declined. Desquamation began on the ninth day, and the bowels continued to act naturally. On the tenth day she took fish, and was ordered full diet on the nineteenth day. The appetite, however, continued defective, and for some days preceeding the thirty-first she did not eat the whole of her dinner. On the thirty-first day there was complete anorexia, and next day she complained of pain in the belly and had two relaxed yellow stools. In the afternoon the abdomen was full and tender, the pulse 130, and the tongue moist and covered with a white fur, and the skin rough, dry, and hot.

During the next nine days, she suffered from fully developed enteric fever, the abdomen being tympanitic, and extremely tender, the bowels acting three or four times a day, and the stools copious, liquid, containing yellow mucous flocculi, and of a pale ochre colour; the cheeks deeply flushed, the tongue dry, with a white hairy fur on the dorsum, and red tip and edges; the pulse ranging from 134 to 120, and the temperature between 105° and 100° Fahr. On the forty-second day she began to improve, and on the forty-fifth the pulse was 124, and of better power; the tongue moist and almost clean; the abdomen free from distension, and only slightly tender to the touch; a softer cooler skin, and one soft stool in the day. The improvement continued, and, excepting a recurrence of diarrhœa on the fifty-second day, she progressively though slowly convalesced. She left her bed on the sixty-fourth day, and was discharged well and hearty on the one hundred and tenth.

Case 31. *Scarlatina; convalescence on the thirteenth day; discharge from the hospital on the twenty-third day; supervention of enteric symptoms on the thirty-seventh day; readmission in a typhous condition, suffering from enteric fever on*

the fifty-eighth day; convalescence on the eighty-first day.— Rebecca K—, æt. 26, had a characteristic attack of scarlatina in the London Fever Hospital. On *the eighth day*, the rash had not entirely disappeared, and the throat was still red and slightly swollen. She resumed ordinary diet on the thirteenth day, and left the hospital apparently quite well on the twenty-third day. The bowels had acted naturally throughout. She was readmitted and again came under my care thirty-five days afterwards (the fifty-eighth day). On inquiry it was found that she had lost appetite shortly after leaving the hospital, and that for the three weeks previous to her readmission, that is, from about the thirty-seventh day, she had been in bed suffering from fever and diarrhœa, and had been gradually getting worse. Her condition was indeed critical; she was delirious, with a fluttering pulse of 144, a dry brown shriveled tongue, and there was sordes on the teeth. The pupils were dilated, the face pale, with a circumscribed dusky flush on either cheek, the abdomen full, tender, gurgling on pressure, and marked with numerous rose papules, and there were frequent pale ochre-coloured, flocculent stools. The thick cuticle of the soles of the feet was separating. Fresh spots continued to appear during the next three days, and the pulse continued very high. The diarrhœa, which had been excessive, was soon completely checked, otherwise she continued in the same critical state until the sixty-ninth day, when an eruption of sudamina over the chest and abdomen, the reappearance of moisture in the mouth, and a diminution of temperature indicated an improvement. The pulse was 120. Next day the sordes began to clear away, there was slight epistaxis, and the pulse was reduced to 112. The bowels were now constipated. On the seventy-eighth day the bowels acted naturally, and the motion was formed; pulse 104; tongue moist but furred; appetite returning. Henceforward she slowly convalesced, the bowels continuing sluggish. She had fish diet on the eighty-first day. She left her bed on the ninety-seventh, and was discharged well on the one hundred and twelfth day from

the accession of the scarlet fever, and the seventy-fifth from the commencement of the enteric.

Case 31. *Severe attack of scarlatina; convalescence on the twenty-seventh day; slight relapse with a trace of albumen in the urine on the thirty-second day; a second renewal of pyrexia on the forty-first day; diarrhœa and pneumonia on the forty-third; continuance of the symptoms; hæmorrhage from the bowels on the forty-seventh and fifty-first day, when she died.*—Sophia N—, æt. 12, was admitted on the second day of a severe attack of scarlet fever. Pulse 140, great prostration, sordes, and a general scarlet rash. The rash persisted for six days and was followed by free desquamation. On the ninth day the glands at the right angle of the jaw began to swell, abscess formed, and pus was evacuated by three successive incisions, a free discharge continuing for twenty days. There was also slight swelling of the glands on the left side of the neck, and for some days ashy mucous ulcers of the tongue. During the first week the bowels were constipated, and one or two doses of house medicine were required; during the fifteenth and sixteenth days there was diarrhœa. The fever continued high until the twenty-second day, the pulse ranging from 128 to 140. From this time she began to improve. On the twenty-fifth day she enjoyed fish diet, and was soon afterwards allowed full diet. Her appetite was moderate and the bowels were rather sluggish. On the thirty-second day the temperature rose 2°, and there was a trace of albumen in the urine. This disappeared by the forty-first day. On the evening of this day there was a renewal of the pyrexia with nausea and vomiting. On the forty-third day, pneumonia of the right lung was declared, and the bowels were very loose. The pneumonia increased, and the diarrhœa continued, accompanied by moderate hæmorrhage from the bowel on the forty-seventh and again on the fifty-first day, when she died, the event being chiefly determined by the pulmonary mischief. No post-mortem examination was made.

Case 32. *Scarlatina; convalesence on the twentieth day; discharge on the thirty-first day; readmission with fully developed enteric fever on the fifty-sixth day; death, ulceration of Peyer's patches.*—Rebeca S—, æt. 22, was admitted into the London Fever Hospital during the decline of a moderate attack of scarlatina. On the twelfth day, the pulse was 112; the tongue red, and dryish at the centre; the fauces still red and swollen; the rash, which had been general and conspicuous, faded; and the skin desquamating. On the fourteenth day, pulse 96; tongue as before. On the sixteenth day, improvement continued; fish diet. Excepting that the appetite continued somewhat defective, she convalesced without interruption, and was discharged apparently well on the thirty-first day. The bowels had acted regularly throughout the attack. She was readmitted under the care of my colleague, Dr. Broadbent, on the fifty-sixth, suffering from enteric fever and having the characteristic rose rash. She stated that she took to her bed the day after she left the hospital (the thirty-second), feeling weak and having no appetite, and that she had not left it since. On the forty-eighth day, diarrhœa came on, and had continued ever since. On admission she had the characteristic symptoms of fully developed enteric fever, including distinct rose papules. The rash continued to appear until the sixtieth day, the diarrhœa of loose, light coloured stools persisted; the urine was albuminous, and she sank on the sixty-fourth day. The post-mortem examination revealed the characteristic lesions of scarlet and enteric fevers. The kidneys weighed each nine ounces, and were soft and congested. The spleen, thirteen ounces, was friable; and there was extensive ulceration of Peyer's patches, and the solitary glands. I am indebted to Dr. Broadbent for this account of the enteric attack and its result.

Case 33. *Moderate attack of scarlatina; convalescence established, and resumption of solid food on the twelfth day; sojourn in the convalescent ward until the twenty-seventh day, when a relapse of pyrexia occurred; symptoms of enteric fever on the thirty-second day. Full development of the same on the*

thirty-ninth day; pneumonia and persistence of the enteric symptoms on the forty-sixth day; death on the fiftieth day; ulceration of the solitary and agminated glands of the intestines.—Jane M—, æt. 11, was admitted into the London Fever Hospital on the second day of an attack of scarlet fever of ordinary severity. The rash was well developed and the fauces and tonsils were congested and swollen, the cervical glands slightly swollen, the pulse 100. The rash and sore throat persisted on the eighth day. On the twelfth she was convalescent. On the twenty-seventh day she was ordered to bed on low diet, on account of a slight relapse of pyrexia with anorexia. Up to the thirty-second day there were no particular symptoms, the bowels had continued to act naturally, and the tongue was commonly moist and coated, the pulse and temperature under 100. On this day, however, there was an increase of the pyrexia, and the child became flushed and stupid, the skin pungently hot, the pulse 108. From this time the bowels gradually became irregular and the stools loose. On the thirty-ninth day, there were four dark yellow watery stools, a full and tender abdomen, and two obscure rose spots, a dusky circumscribed flush on each cheek, a hot, dry, harsh and still desquamating skin, pulse 116, a clean red tongue inclined to become dry and to fissure in the centre. The mind was dull and the body rapidly emaciating. On the forty-first day she lay in the same state, the abdomen a little more tense, the tongue dry and wrinkled, the angles of the mouth and orifices of the nares excoriated and bleeding, diarrhœa moderate, and the stools characteristic of enteric fever.

On the forty-sixth day, the pulse rose to 120, and symptoms of pneumonia appeared. On the forty-eighth day, there was marked consolidation of the lower portion of the right lung, and the respirations were 34. The diarrhœa continued, and the patient died on the fiftieth day from the accession of the scarlatina.

The body was greatly emaciated, a large gland overlaid the right mastoid process, and there was a chain of enlarged glands on the left side of the neck. The left pleura were

healthy, but there was a patch of hardened fleshy lung, which sank in water, about two inches across in both the upper and lower lobe of the lung of this side. There was pleuro-pneumonia of the right side, and the lower lobe was in a state of red hepatization and sank in water. The right cavities of the heart, the cavæ and pulmonary artery, and their primary branches were obstructed by firm colourless clots; the liver pale and fatty, forty-nine ounces: the gall bladder full of watery grumous, pale orange-coloured bile, bright and clear on standing, feebly alkaline, sp. gr. 1012·5. Pettenkofer's test gave only a faint, dirty purplish-brown tinge; 1000 gr. measures yielded, at 212° Fahr., nineteen grains of brittle yellow extract; the kidneys were healthy, weighing together nine and a half ounces; the spleen, five ounces, was firm and flabby; the mesenteric glands enlarged, flabby, and of a chocolate-brown colour; the intestines were moderately distended with air, and contained soft pale ochre coloured masses of fæcal matter; the mucous membrane of the small intestines was moderately injected. The last two feet of the ileum was the seat of twenty rounded ulcers, varying from a quarter to three quarters of an inch across. The ulcers occupied the sites of the agminated glands, and the large Peyer's patch, which is placed about two inches above the valve, contained within its area four of these ulcers; they were generally pale and smooth, and the edges even and rounded. The edges of a few were thicker, very vascular and angry-looking. Some of the ulcers lay so near the peritoneal coat that their situation was marked externally by a vascular area. All were in process of healing, and three or four Peyer's patches presented a smooth, injected, rose-coloured cicatrix effacing a considerable portion of the glandular structure. The mucous membrane of the large intestine was considerably injected, and the solitary glandulæ of the transverse colon were swollen, and many of these ulcerated, the ulcers ranging in size from a slight abrasion of the central depression of the gland, to half an inch across the widest part. The edges of these ulcers were slightly raised; some were dark and vascular, others had an ashy appearance. The glandulæ

of the other portion of the large intestine were swollen, and of a darker colour than the mucous membrane surrounding them.

Having now traced the relation which subsists between scarlatina and enteric fever to its extreme results, I will, with the view of giving more completeness to my account, narrate a few instances in which symptoms of the two diseases coexisted. And, as an appropriate introduction to these examples, I will briefly indicate the points where the outward symptoms of the two diseases meet and overlap one another. In the early stages of scarlatina and enteric fever the bowels are usually confined; in the latter stage of scarlatina they are occasionally loose, and the stools have the same character as those of enteric fever. Rose papules are not to be observed in many cases of enteric fever; and they may, if carefully sought for, be occasionally found in scarlatina. But such papulæ as usually occur in enteric fever—I mean the few, often indistinct rose spots which mark the pallid skin, and which we may properly regard as diagnostic of the disease—such papulæ, I say, can hardly, or not at all, be discovered amongst the rough and vivid rash of scarlatina. It is only, therefore, when the rose papules are very distinct and well developed that we can expect to distinguish them positively in scarlatina; yet this may be done in no inconsiderable number of cases. But if the scarlet rash be fading, as is usually the case when the papulæ appear, then they are sufficiently distinct; and if we should see the patient for the first time at this stage of the disease, and particularly if the bowels happen to be loose, we should conclude that he was suffering from enteric fever, and such would surely be the correct diagnosis; but we must not, on that account, ignore the fact that a few days before, the disease was well marked scarlatina. A large number of cases of enteric fever may thus be traced back to their origin in scarlatina; and it is as incorrect as it is unscientific to divide the train of outward symptoms which constitute the phases of one morbid condition into two sets indicative respectively of two specifically distinct diseases—so regarded. All such classification puts an artificial line of demarcation where no

real limit exists, and, for a time at least, effectually bars the advance of truth.

Excepting perhaps the flushed cheek, the mark of persistent abdominal irritation, there is no feature of enteric fever, which may not be observed in many cases of scarlatina; and conversely, a large number of patients who come under our notice for the first time suffering from enteric fever, will present the pallid face, the excoriated nostrils, the large red lingual papillæ and tonsils, the moniliform glands, and, occasionally, the aural discharge of a declining attack of scarlatina.

Again, some albuminuria is a common associate of scarlatina, but it may occur at any period of an attack of enteric fever. The urine of one of my patients who died of frightful sloughing of Peyer's patches on the 20th day, was loaded with albumen for four successive days before her death; and at page 571, vol. 1, of 'Reynolds' System of Medicine,' I have given the history of another case in which albuminuria and general anasarca immediately followed an attack of enteric fever.

To proceed with examples of the concurrence or intercurrence of scarlet and enteric fevers:—

Case 34. *Mixed scarlet and enteric fevers; convalescence on the thirty-fifth day.*—Betsy D—, æt. 24, was taken ill with rigors, headache, and sore throat. A well-developed scarlet rash appeared on the second day, when she was admitted into the hospital.

3rd day.—P. 120; skin hot, and covered with a moderate typical scarlet rash; tongue moist, with a yellow fur.

4th day.—P. 124; tongue dryish; still a general scarlet rash with a copious eruption of distinct rose papules over the chest and abdomen; bowels sluggish; ordered ℥ss Olei Ricini cum ♏x Tr. Opii.

5th day.—Pyrexia increased; tongue dry; delirium; one costive stool.

6th day.—P. 120; tongue dry; quiet delirious; no action of the bowels. The oil and opium were repeated.

7th day.—The general scarlet and papular rose rashes persisted; the oil acted twice.

8th day.—P. 108; scarlet rash paler; the rose papules continued of a bright colour; two natural stools.

9th day.—P. 108; tongue parched; cheeks flushed.

10th day.—Delirium continued; bowels confined; slight bronchitis.

During the next five days the rash disappeared, the cough became troublesome, with frothy expectoration, the bowels acted regularly without medicine, the pulse ranged from 120 to 100, and there was a general improvement, the expression becoming more lively and the intellect clear.

From the fifteenth to the twenty-fifth day the bowels were occasionally loose, and solid food, for which she had a desire, provoked diarrhœa. A small slough formed on the nates, otherwise she progressed favorably.

On the thirtieth day she was able to take fish, and thenceforward she convalesced without any drawback.

Case 35. *Mixed scarlet and enteric fevers; convalescence on the twenty-eighth day.*—Harriet B—, æt. 21, one of a family in which several children were ill of scarlatina. Her illness commenced with rigors, sore throat, and general scarlet rash.

She was admitted on the fourth day, when the pulse was 120, the skin moist and covered with a faint scarlet rash; the tonsils and fauces congested and swollen.

On the fifth day the skin was perspiring and the rash gone; the tongue moist with a silvery fur; the bowels as yet acting quite naturally.

On the evening of the sixth day she had three loose ochre-coloured stools, and there was slight delirium.

On the eighth day the diarrhœa had ceased; pulse 104; the tongue moist, with elevated papillæ.

On the eleventh day the bowels were again loose, and there was slight sordes on the teeth; pulse 100.

On the thirteenth day continuance of the diarrhœa; abdomen a little full and tympanitic; a single rose papule.

Pulse 108; tongue brown, parched; cheeks flushed; a little dry cough; in a word, the typical appearance and symptoms of enteric fever.

The diarrhœa decreased, and the condition of the patient improved, and on the twentieth day there was but one lax motion in the day; pulse 100; tongue moist, and rather red, with a scattered white fur.

She had fish on the twenty-third day, a chop on the twenty-eighth day, and thenceforward convalesced rapidly.

Case 36. *Mixed scarlet and enteric fevers; convalescence on the forty-fifth day.*—Sophia A—, æt. 26, engaged as night nurse in one of the scarlet-fever wards of the London Fever Hospital.

After ailing for three days was taken with rigors, sore throat, and the eruption of a scarlet rash and general pains; pulse 132; tongue moist, and slightly coated.

During the next four days the throat continued slightly swollen and sore, the bowels remained constipated, and she had two doses of house medicine; the pulse ranged from 128 to 116.

On the ninth day the cheeks were deeply flushed, and the bowels became loose, and in the evening there were five distinct rose papules on the abdomen: pulse 120.

The diarrhœa and a copious eruption of rose papules continued until the twenty-first day, and she became reduced to a critical condition, the pulse ranging from 120 to 130.

On the twenty-second day the pulse was 132, and there were sordes on the teeth, and a dry brown tongue.

On the twenty-fifth day the stools were improved; the pulse was 120, and stronger.

From this time she gradually improved, and was convalescent on the forty-fifth day.

The intercurrence and sequence of scarlet and enteric fevers has been noted by several authors, and attributed to accidental coincidence. I believe that I have now adduced sufficient evidence to satisfy an unprejudiced mind that it is

due to a most intimate pathological relationship; in a word, that the pathology of scarlatina is precisely that of the first stage of enteric fever. In my article on "Enteric Fever," in Reynold's 'System of Medicine,' I have already expressed my convictions on this matter, and so strong were they at the time that work was publishing that I find I have in the proof sheet applied the term "Abdominal Scarlatina" to the contagious variety of enteric fever. I abandoned the use of the term at that time because it seemed to me that the evidence which I had adduced to show the connection implied by it was insufficient to convince those whose opportunities for examining the question in detail are rare, and whose scholastic principles would be shocked by such confusion of two diseases so universally regarded as specifically distinct. Now, however, that I am enabled to lay before the Society the full and complete evidence continued in the foregoing observations I will submit this term "Abdominal Scarlatina" to the profession as the appropriate definition of a disease which every intelligent practitioner will sooner or later meet with. Nor will I allow the opportunity to slip me, but in the interests of truth, as opposed to dogmas worthy of the dark ages, will ask my fellow labourers to go one step further with me, and discarding those transcendental ideas of enteric fever which make of it a specific disease dependent on one particular poison, open their minds to receive what experience will then soon teach them—that enteric fever, and all its attendant phenomena, may occasionally become a part of almost any other general inflammatory condition, specific or simple.

In conclusion, I desire to record my obligations to Dr. William Henderson, the resident medical officer of the London Fever Hospital, in charge of my cases, for the ready and efficient help which he has given me in the wards and mortuary in following out my observations on the foregoing cases.

TUBERCULAR FEVER

AND ITS

RELATION TO ENTERIC FEVER.

By JOHN HARLEY, M.D.

The object of this communication is, in the first place, to give an account of tubercular fever; and, in the second, to show its relation to enteric fever. The subject will necessarily involve a brief consideration of the nature of both diseases.

A fair history of the origin and progress of tubercular fever will be obtained from the thirteen cases detailed in the following pages. I have found them scattered through the note-books referring to patients admitted under my care into the London Fever Hospital. Excepting one, which is clear enough, I have selected only those of which I could give a *complete* account, and these are necessarily fatal cases. In each case a clear and positive diagnosis was made during the life of the patient, and the cases were respectively designated "tubercular pneumonia," "tubercular meningitis," and "enteric fever," with or without pneumonia. I have applied the term tubercular fever to them collectively, instead of acute tuberculosis, inasmuch as this latter term implies a more chronic and less febrile condition than is exemplified in the following cases.

With regard to the second topic, the relation of tubercular and enteric fevers, the observations I have to make are I believe new, unfamiliar, and, therefore, discordant to received opinions respecting the nature of the latter disease. Medical authors,

it is true, have noted the occasional association of tubercle and enteric fever, but they have all regarded it as a rare and accidental complication, or as a sequel arising from the debility caused by a prolonged attack of the enteric disease. The evidence which I lay before the reader will, I believe, be sufficient to convince him, not only that tubercle may form an actual component of enteric fever, but that fully developed enteric fever may be solely caused by the simultaneous eruption of miliary tubercle in the intestinal glands and in the lungs.

The whole subject of enteric fever is so hedged in by narrow views as to admit of no manner of question as to its nature and cause. "It is a specific disease due to the absorption of a specific poison derived from putrescent animal or vegetable matter." Men who hold this stereotyped view will be ready to say that Case 10, for example, "furnishes no proof whatever of the absence of the proper poison; on the contrary, it is clearly there, and has, amongst other things, caused the outburst of tubercle." Well, this is the case of St. Peter's hair over again, or rather of St. Peter's no hair. You are asked to believe in the presence of the no hair, as the priest seemingly draws it out between his thumb and finger before your eyes; if your fancy is good you see it at once and clearly, but if you rely only on your gross fallible senses you see nothing, and the professor shakes his head, sighs, and tenderly laments your lack of faith. The grovelling daughter of ignorance, the cankerworm of science, preys much on medicine. As men of science we should never forget the wholesome maxim not to seek the explanation of a connected set of phenomena in more causes than one if that one be sufficient. "But is not the specific poison a sufficient cause?" my opponent will say. "No doubt, if it exists," I answer, "but I have never seen the specific poison. The turgid blood-vessels, and the masses of extruded matter lying upon them, I *have* seen, and to me *this* is the inflammation, and *here* is the efficient cause of all the attendant and consequent phenomena." Is it not so in pleurisy, in pneumonia? Why should it not be so in inflammation of the intestinal glands? Another exception arises. "The inflammatory product

in enteric fever is a *specific deposit*." Then (still referring to Case 10) we may have two kinds of specific exudation deposited simultaneously, the one in the intestinal glands, the other in the lungs or any other part. This, I think, we may fairly conclude is absurd. To grant, then, that the cause and symptoms of enteric fever are occasionally due to tubercular deposit is to set aside the notion that tuberculosis and one variety at least of enteric fever are specifically distinct.

I have long advocated more comprehensive views of the nature of enteric fever, and have insisted that it may arise in any simple inflammatory condition of the body (particularly pneumonia) as soon as the inflammatory action involves the glands of the ileum or colon, and I have shown[1] that this disease is a natural pathological sequence of scarlatina. Case 5 illustrates this sequence, but here the enteritis has assumed the tubercular form.

Nor can the so-called tubercular diathesis be properly regarded as anything more than the result of a greater delicacy of the tissues, or less retentive power of the capillary blood-vessels. The difference, for example, between simple and tubercular pneumonia is merely one of degree. The deposit is excessively fine in the former case, coarse in the latter, and a careful observer will find every intermediate degree in different individuals, and often find it impossible to say whether in a given case the deposit be tubercle or simple exudation. In the robust subject the effusion of coagulable matter is moderate, and lies close upon the outside of the vessels from which it was parted, and within the influence of the absorbent function; and thus upon arrest of the inflammation it may be removed. But it is otherwise with the delicate subject, the frame of tender build; the effusion is poured out more abundantly, and at once forms masses lying indeed upon the blood-vessels, on one side, but too far separated from them on the other to be within the influence of absorbent action. Hence, too, the difference in the pulmonary symptoms in the two cases. In the simple or molecular form as I would call it, of pneumonia the crepitation is excessively fine; while in the granular or tubercular form, coarse crepitant râles are the characteristic sounds. If the

[1] "The Pathology of Scarlatina and the Relation between Scarlet and Enteric Fevers," 'Medico.-Chirurg. Trans.,' vol. lv.

lung break down in both cases, the process in the one is rapid, in the other chronic; in the one the expectoration is a thin purulent fluid, in the other it is thick and nummular. But here again variation of constitution produces a corresponding variation in the symptoms. Nature has imposed no limits between simple and tubercular inflammation. The highest powers of the microscope fail to show any difference between recent tubercular deposit and that resulting from simple inflammation. How unreal, then, is the old-fashioned but persistent distinction! Even the few cases I bring together in this communication disprove it over and over again. Are not Cases 12 and 13 capital instances of tubercular meningitis? and yet the solid exudation in the brain did not in either case take the form of tubercle. Not only may recent molecular exudation and old tubercular deposit be observed in remote parts of the same lung, but recent miliary tubercle and the molecular deposit of simple pneumonia may sometimes be continuously traced, by the naked eye, as well as by the microscope, the one into the other.[1] While microscopists quibble about the characters and transformations of tubercular deposit, the physician must avoid being misled by the confusion they create, and hold steadily to the simple teachings of nature.

In defining the association of lung and bowel inflammation in several of the following cases, I have used the term *pneumonenteritis* to denote this condition. It is a term which might be very usefully employed to reclaim a vast number of

[1] At one time of life the blood-vessels may be more retentive than at another, and a person who in early life has had limited tubercular disease of the lungs may subsequently die of molecular pneumonia. Thus John Maskall, æt. 10, after a short illness died of pneumonenteritis. The body was well developed and fairly nourished, but the bones of the lower extremity were slightly curved; the *left lung* weighed ten ounces, it was engorged and friable, being in a condition nearly approaching to red hepatization; in the apex there were several separate masses of old yellow tubercle the size of peas. The *right lung* weighed twelve ounces, it was bound to the chest by firm old adhesions. The lower and middle lobes were adherent and in state of red hepatization, sinking in water, very friable, and the broken surface having the very fine granular appearance of ordinary pneumonia. The upper lobe was in a less advanced stage of the same condition and free from a trace of tubercular deposit. *Peyer's patches* were slightly swollen and congested, and the solitary glands were in a state of psorentery, the lower ones approaching the ulcerative stage. See also Case 9.

cases of enteric fever from the category of specific disease, by referring them to a simple inflammatory action resulting, like ordinary pneumonia, and Cases 1 and 10 narrated below, from exposure to cold.

Case 1.—*Acute general tuberculosis; death from exhaustion on the fortieth day; gallstones.*

Susan King, æt. 40, complexion dark, hair abundant and grizzled, admitted on the thirtieth day of her illness, which commenced with weakness and a violent cold, followed by diarrhœa and fever.

31st day.—Pulse 108; skin moist and hot; bowels inactive; respiration 28. Occasional cough and copious clear frothy expectoration. The chest was resonant, but there was coarse crepitation in the lower lobes of both lungs. At times she was delirious.

32nd day.—Bowels acted once; the stool was formed, and of a bright gamboge colour.

33rd day.—Three loose stools. Delirious and refused to answer. Crepitation extended over the back of the chest.

She continued to get worse, becoming drowsy and apathetic. The pulse varied from 100 to 116; the tongue became dry and brown; and although the abdomen was collapsed, there was persistent diarrhœa, the stools being pale and watery and on the

39th day the watery stools were passed involuntarily. She lay on her back, and there was twitching of the lips. The pupils were equal, moderately dilated, and sensible to variations of light. There was no appreciable dulness of the chest, but there was diffuse coarse crepitation. The pulse rose to 128 next day, when she sank and died, the diarrhœa persisting to the last.

The body was emaciated. The upper part of the *ileum* was firmly invaginated for four inches, but there was no swelling or inflammatory action whatever. *Peyer's glands* were slightly swollen and injected. The *solitary glands*, for a distance of three feet above the valve, formed white prominent elevations, a few only being red. The glandulæ of the large intestine were healthy. The ascending *colon* was vividly injected with points of ecchymosis. The *mesenteric glands* were healthy. The mesentery and mesocolon presented a number of circular black spots, with soft yellowish centres, old extravasations of blood, doubtless. The *liver* was a little fatty, and weighed three and a half pounds; the outer surface presented at intervals patches of miliary tubercle. The gall-bladder was collapsed and contained twenty small, angular, yellow gallstones.

The *spleen* was greatly enlarged, weighing fourteen and a half ounces, and was abnormally firm, but sections had a natural appearance. The *kidneys* weighed together eight and a half ounces; the cortical portions were studded with greyish-white raised tubercles, exactly resembling those of the pleura. The surfaces of the *mesentery*, and of the *peritoneum* in contact with the liver, were also strewn with miliary tubercle. The *pleural surfaces of both lungs* were rough, and appeared as if dusted with fine sago, and both organs were everywhere pervaded

with similar greyish-white miliary tubercles, which contrasted vividly with the firm, dark-red, congested tissue between them; the left weighed twenty-five ounces, it was bound behind by old adhesions; the right weighed thirty-two ounces. The bladder was distended. Excepting a slight deposit of jelly-like lymph upon the membranes covering the pons, and thence to the optic commissure, the brain and its membranes were healthy.

Here is an instance of general inflammation of the parenchymatous organs with *tubercular* effusion into the lungs, the pleuræ, the kidneys, the solitary glands of the ileum, and probably the spleen, and *molecular* (common) effusion upon the membranes at the base of the brain.

Case 2.—*Acute tubercular pleuro-pneumonia in a scrofulous subject; death on the thirty-third day.*

Thomas Quinlan, æt. 19, admitted 13th September, 1870, on the third day of his illness, which began with pain in the chest and great weakness. The left side of the neck was seamed with old strumous cicatrices.

3rd day.—Physical signs of consolidation of the whole of the left lung, with fine crisp crepitation. Similar crepitation, but no marked dulness or bronchophony in the antero-inferior part of the right lung. Pulse 144, resp. 36. Flushing; sordes. Tongue moist, with a yellow fur.

The patient continued in much the same state until the twenty-sixth day, the bowels being rather confined, the cough slight, and expectoration of viscid mucus scanty. He lay chiefly on the right side, and although the respirations sleeping were usually 40 in the minute, he was tranquil and seemed free from all distress, and slept and spoke calmly. Latterly there was profuse sweating, and beads as large as peas constantly accumulated on the flushed face.

On the 28th day he was evidently growing weaker, the pulse being 136, resp. 44, and the temp. very high, notwithstanding the copious perspiration. The expectoration had become freer, and was partly frothy and tenacious, and partly smooth. The weakness increased without any other alteration in the condition of the patient, and he gradually sank and died on the thirty-third day.

The *left lung* was enormous; it was fully expanded and consolidated, forming a complete cast of the right chest, showing depressions corresponding to the ribs, pericardium, and diaphragm, and weighing three pounds seven ounces! It was everywhere adherent by a thick, leather-like, recent membrane. It was infiltrated with yellow tubercle, which, having completely invaded the lung-tissue and become confluent, rendered the organ almost non-vascular, and gave it a dry, marbled, red-and-white appearance. The apex had broken down into a cavity the size of an egg, and there were small tunnels in the immediate vicinity converging into the cavity.

The *right lung* was similarly adherent; it was also nearly solid, friable, and red, and presented nodules of yellow confluent tubercle here and there.

One Peyer's patch was slightly raised, and the mucous membrane of a portion of the ileum was so vascular as almost to bleed.

Case 3.—*Acute tubercular pneumonenteritis; suppuration of the lung; recovery.*

Mary Roach, æt. 25, was admitted on the fourteenth day of her illness (22nd March, 1870), which began with rigors, pain in the back and stomach, and sickness.

16th day.—Pulse 104; skin hot; tongue moist, thickly coated with chalk-like fur. Bowels loose. Vomited a little dark bilious fluid.

18th day.—Pulse 88. Bowels still loose, and motions green and semi-solid. Had a slight cough and scanty muco-purulent expectoration. No physical signs of pulmonary disease. There was general desquamation of the cuticle, such as occurs after an ordinary attack of scarlatina.

28th day.—Continued in the same state, but some large crepitation was heard in the lower part of the right lung. The expectoration was purulent and flaky, and the loose stools were yellow.

30th day.—Sputum nummular.

Up to the 50th day her condition was unchanged. She lay in an apathetic state, apparently incapable of comprehending, and never answering the questions addressed to her. The brain was probably oppressed by slight effusion. The pulse ranged from 132 to 100, the temperature remaining high (about 103°), and the skin dry throughout. The diarrhœa was kept in moderate control by opiate enemata. There was occasional vomiting of greenish bilious fluid. The cough was troublesome, and the expectoration was abundant and purulent.

On the 52nd day she was much improved, beginning to observe what was going on around her, and answering questions. The vomiting had ceased, the febrile symptoms were diminished, and the diarrhœa was in abeyance. The dry parched tongue became moist again, and assumed the chalky-white fur which characterised it in the earlier part of her illness. The right upper lobe of the lung gave imperfect resonance and respiratory sounds, and the expiration was prolonged. The physical signs were not very marked, but, considering the character and quantity of the expectoration, it was pretty clear that the upper part of the right lung was breaking down. There was no apparent emaciation, no marked clubbing of the nails, but the hair was falling off.

No marked progress occurred until about the sixty-fourth day, when the tongue became clean, and a healthy hue returned to the face. The sputum, which had again become more consistent and nummular, now began to decrease in quantity, and when she was discharged, a fortnight afterwards, the cough and expectoration had nearly ceased, the appetite was normal, and the bowels regular.

Viewed in the light of the other cases, and with the positive evidence furnished by nummular sputum, I think it will be conceded that the diagnosis which I have given of the foregoing case is correct.[1]

[1] The more diffuse suppuration of simple pneumonia, as far as my experience goes, furnishes a different sputum.

CASE 4. — *Acute tubercular pleuro-pneumonia; severe and persistent diarrhœa; slight deposit of tubercle in the ileal glands; death on the thirtieth day, the event being accelerated by epilepsy.*

Kate Newman, æt. 18, was admitted on the seventh day of a febrile attack, which began with headache, shivering, and looseness of the bowels.

7th day.—Pulse 120; skin hot and dry; tongue white and moist, but inclining to dry; respiration 30; lower lobe of right lung dull, with fine crepitation; a dry cough; bowels loose.

9th day.—Sharp pleuritic pain beneath the right nipple; bowels very loose, stools light coloured.

10th day.—Pulse 132; resp. 36; cough still dry; free perspiration.

12th day.—Crepitant râles over the whole of the right lung, very crisp at the apex; scanty muco-purulent expectoration; left lung normal. The bowels had acted once a day only during the last three days.

15th day.—Had an epileptic fit (to which she was liable) to-day.

16th day.—Signs of increasing consolidation of the right lung, crepitation becoming general in the left. Pulse 120; cheeks flushed; return of diarrhœa.

18th to 21st day.—The diarrhœa was checked to-day. Pulse 132; resp. 48; cough very troublesome, with scanty expectoration of frothy mucus.

24th day.—Tongue white and moist; temp. 103° Fahr.; much flushing. The whole of the right chest dull, with fine, dry, crepitant inspiration, most marked at the apex, and bronchial breathing, wheezing, and crepitation, in the left apex; cough short, dry, and troublesome.

25th day, 9 a.m.—Temp. 104°; 9 p.m. 103·4°.

26th day, 9 a.m.—Temp. 102·4°.

27th day, 9 a.m.—Temp. 103°, 9 p.m. 102·6°; pulse 144, thready; resp. very short, frequent. The cough was still very troublesome, and at times she now expectorated an ounce of frothy, nearly clear bronchial sputum. This began to excite vomiting, and her strength was rapidly failing. On the

30th day she was seized with another epileptic fit, which lasted ten minutes, and terminated in death. She continued bright and intelligent up to the time of this convulsive attack.

The body was slender and somewhat emaciated. *The right lung* was adherent to the chest-wall and diaphragm by new and tender dryish membrane; it weighed forty-two ounces. The whole lung was disseminated with rather coarse granules of yellow tubercle, which were separated by very short intervals of bright red, half-consolidated lung-tissue. The apex was quite solid, the tubercles being nearly confluent. *The left lung* weighed fourteen and a half ounces; it was partially adherent at both base and apex. The apex was slightly wrinkled, back and front, and beneath the puckerings were masses of fine granular tubercle. The lower lobe, particularly the posterior part, was strewn with yellow tubercle, but more sparsely than the right. *The spleen and mesenteric glands* were normal. *The small intestine* contained slimy, semifluid, gamboge-coloured fæcal matter. Ex-

cepting a little yellow deposit in a few of the follicles of a Peyer's patch here and there, and a similar swelling of a few of the solitary glands, the ileum was healthy.

The brain and its membranes were healthy; the ventricular fluid was rather abundant.

Here with a strong tendency to cerebral excitement the brain escaped all inflammatory deposit.

CASE 5.—*Scarlatina, followed by tubercular pneumonenteritis and suppuration of the lung; death on the thirty-eighth day.*

Alice Allaway, æt. 15, admitted on the third day of an attack of scarlatina.

3rd day.—General scarlet rash; fauces and tonsils deep red and swollen; pulse 100; tongue red, clean, and moist: constipation.

4th day.—Pulse and tongue unchanged; pupils moderately dilated; rash fading; bowels open.

5th day.—Palse 104; tongue moist; rash still present.

6th day.—Pulse 92; skin cool; tongue dry in the centre; slight sordes; slight delirium.

7th day.—Troublesome cough; respiration slightly accelerated; large crepitation over the back of the chest.

8th day.—Pulse as the two previous days, 92; tongue moist, slightly coated. The active pulmonary congestion progressed, as was evidenced by increasing dulness of the chest and frequency of the breathing. On the

14th day.—The lower two thirds of the left lung was completely dull, and tubular breathing had in great measure taken the place of the crepitant sounds. She lay on the left side; the pulse was 124 and full; the face was flushed; sordes accumulated on the teeth; the tongue was dry in the centre; the rash had disappeared, and there was much desquamation. The abdomen was moderately distended, diarrhœa set in, and the liquid stools were of a light yellow colour.

17th day.—No amelioration; pulse increased to 136; respirations to 44; tongue dry and fissured; large patches of cuticle were still separating; the abdomen was not so full, but there was gurgling on the right side and moderate diarrhœa.

20th day.—In the same condition; distressed with a harsh cough; no expectoration; pulse 144; respiration as she slept 36; face pale and pinched; bowels still loose.

For the next two days she improved considerably. During this time there was only one rather loose stool; the pulse fell from 116 to 108, the tongue was moist, and the sordes began to clear away; the cough was less severe, and she took custard.

25th day.—Worse again. Pulse 124; respiration 32; return of diarrhœa; pallor and prostration; the cough deep and powerless; lay sleeping on the left side with the eyelids a little separated. She continued in the same state for the eleven days following, the cough and diarrhœa persisting, the former being short frequent, and unattended by expectoration.

37th day.—The thin pulse was composed of 132 feeble undulations; the tongue was moist, red, and but slightly coated; there were two liquid pale evacuations; she still lay on the left side, scarcely alive, and this morning expectorated half a pint of yellow pus. The next day she died of prostration, having made, during the preceding fortnight, two or three attempts to rally.

The body was completely emaciated, the abdominal parietes being excessively thin; the pale, mottled, fatty *liver* descended to within half an inch of the navel line: it weighed forty-two ounces; there was an ounce of dark green bile in the gall-bladder. The *spleen* was pale, of normal consistence, and weighed three ounces. *The mesenteric glands* were large, dusky, soft, and leathery. *The Peyerian glands* near the valve were thickened and congested; those for some space above were congested and slightly swollen. The mucous membrane of the ileum presented patches of injection. There was general psorentery of the solitary glands in the last foot of the ileum, the glands being white, firm, and prominently raised. *The kidneys* were healthy but pale, and weighed together seven and a half ounces. *The right lung* was bound above and behind by old adhesions; it weighed fourteen and a half ounces, and was everywhere crepitant and free from deposit. *The left lung* was also firmly adherent at the side; it weighed thirty-five ounces; the apex only was free from deposit, and retained crepitancy, though but feebly; the lower part of the upper lobe was firm and excavated by small, tunnel-like, ragged cavities; the lower lobe was everywhere thickly strewn with fine granules of yellow tubercle, some of which were confluent in masses the size of a pea.

Scarlatina frequently passes into enteric fever by necessary pathological sequence, and the foregoing history is a case in point, the only difference being that in this case the deposit took the tubercular instead of the simple inflammatory form.

The one lung escaped, probably, on account of defective vascularity from previous disease. The enteric inflammation was in this case quite secondary to the pulmonary.

Case 6.—*Acute tubercular pneumonentritis; death on the thirteenth day from the accession of the febrile symptoms.*

Kate Gaynor, æt. 7½, admitted January 4, 1870; the members of her family are healthy except one who has some "complaint of the chest." The patient had been failing in health six weeks, and ill with fever and shortness of breath the ten days before admission.

10th day.—Great prostration. Sordes. Pulse 132; respirations 70. Skin dry and hot.

11th day.—The prostration was too great to make a thorough examination of the lungs, but there was diminished resonance, and diffuse coarsish dry crepitation over the whole of the back, with pleuritic sounds. Pulse 152; resp. 70.

12th day.—Decubitus on right side; pulse 160; resp. 80. Knees drawn up abdomen moderately full, painful on pressure. Bowels open, loose.

13th day.—Increased prostration and death.

The body was slightly emaciated. *The lungs* were swollen, heavy, and but slightly crepitant, the lower lobes were adherent to the chest wall by soft lymphy exudation. The texture of the lung resembled that of the adult spleen, and every portion of both lungs was thickly studded with white opaque miliary tubercle, the intervening lung tissue being engorged and of a vermilion-red colour. *The mesenteric glands* about the lower part of the ileum were enlarged and purple. A distinct deposit of yellow tubercle, the size of a pea, occurred in the mucous membrane of the *jejunum*. The lower end of the *ileum* was severely congested, the vessels being perfectly injected and turgid, there was general psorentery, the straw-coloured glands appearing like a pustular rash upon the purple mucous membrane: two feet from the valve many of the solitary glands were more diffusely swollen, purple, and ulcerated at the centre. The two *Peyerian glands* next to the valve had each two round ulcers ¼″ in diameter, the edges were red and raised, and the centres were dark and sloughy. A foot from the valve a similar ulcer occupied the centre of another Peyer's patch, which was generally inflamed and swollen. The agminated glands generally were purple and swollen and one or two almost bleeding, and at intervals as high as the first fourth of the ileum their centres were occupied by angry ulcers. *The cæcum* was greatly congested. *The spleen* weighed 3¾ ounces; in appearance it resembled the lungs, but it was more compact and the tubercular matter was in finer grains. The brain, kidneys and supra-renal organs and liver were healthy. The gall-bladder contained a moderate quantity of healthy bile.

On admission the symptoms of both pulmonary and enteric inflammation were well developed; previously there had been no diarrhœa. The tubercle was no doubt deposited in the affected organs simultaneously. The pulmonary symptoms were prominent throughout; the enteric disease was only declared three or four days before death, although during the period of its latency it had partly passed into the ulcerative stage.

CASE 7.—*Acute tubercular pneumonenteritis with symptoms of severe enteric fever; pneumonia on the eighteenth day; cessation of the enteric symptoms on the thirty-second day; extension of the pulmonary disease with suppuration; death from asthenia on the sixty-third day.*

Isabella Beaver, æt. 19, admitted 11th August, 1870, on the sixth day of a febrile attack of which no satisfactory history could be obtained.

6th day.—Pulse 116; tongue white and moist; skin hot and pallid; one rose spot on the abdomen, and there had been two liquid light ochre-coloured stools during the previous twelve hours.

8th day.—The patient was in a listless state, with the eyes wide open, and occasionally delirious. No answer could be obtained from her, and she held fluids a long time in her mouth before she attempted to swallow them. Pulse 120.

9th day.—The nape having been effectually blistered, she exhibited more intelligence to-day, but the diarrhœa continued.

10th day.—Twice had considerable hæmorrhage from the bowel, and this recurred on the eleventh day when the pulse was 144; the tongue yellow and moist, and the general condition and appearance of the patient was much improved.

13th day.—Pulse 132, respiration 32; which led to an examination of the chest; the respiratory murmur, however, was still normal. There were six liquid stools during the previous twenty-four hours, but the hæmorrhage had finally ceased.

18th day.—The diarrhœa continued profuse; the cheeks were flushed, and there was muscular tremor and great restlessness. Crepitant râles were now heard over the back of both lungs, and there was occasional cough, but no expectoration. The pulse 132, the respirations 32.

On the nineteenth day there was scanty expectoration of frothy mucus, and on the twenty-first day the expectoration was free, otherwise she remained in the same critical state, the diarrhœa still persisting, and the respiration being 36. She continued in the same state, with a pulse of 132, during the next week, but on the twenty-seventh day there was decided improvement, the bowels which had been moved three times the previous twenty-four hours were now quiet. She slept comfortably under the influence of twenty grains of chloral hydrate, and the respirations while sleeping were reduced to 24. The expectoration was purulent.

37th day.—The diarrhœa having now ceased for several days, and the patient being generally much improved, she was allowed fish diet. Constipation followed, the abdomen being dull and retracted, and on the forty-seventh and four following days, simple enemata were given, and each brought away a stool composed of brown fluid and numerous scybala.

On the 51st day the motion consisted of dark-brown slimy fæces destitute of scybala; the pulse was 128, respiration about 30, the skin cool; the patient looked bright and clear, but she was greatly emaciated, and was much troubled by a hard cough attended with free expectoration of mucopurulent matter. The chest was now dull behind and over the left front, and the respiration was bronchial. Although the appetite was good, the pulse was small and feeble, and the emaciation continued. She was now contending with the suppuration of the lungs, and resembled a patient in the last stage of phthisis.

On the 60th day she was much worse from failure of heart force. She rallied, however, and on the sixty-second day the thready pulse was 120, the respiration 30; the tongue was clean and dryish, the cough loose, and the expectoration opaque, purulent, and smooth. The next day, however, she relapsed and, having gradually sunk, died on the sixty-fifth day.

The body was completely emaciated. The apex of the *right lung* was strewn with sago-like grains of tubercle. The apex of the *left* lung was excavated into a ragged cavity, invading the whole upper third of the lung, the contiguous portions being riddled and tunneled with purulent passages. The lower two thirds of this lung were quite solid, the semihepatised red tissue being crowded and mottled with grains of yellowish tubercle the size of a millet seed. The intestines were greatly attenuated. The *peritoneum* was quite healthy, excepting that

there were three or four little rounded masses of solid lymph upon the lower third of the *ileum*, and these corresponded to ulcerations which had passed through all the coats of the bowels, and thus extravasation was prevented. The lower third of the ileum was very thin and fragile; all the *Peyerian glands* were occupied by depressed, ashy-looking, smooth ulcers, about the size of a shilling; they were all in an advanced state of cicatrization, but the edges of some were raw with fine red granulations.

In this patient the deposit of tubercle in the lungs was declared on the thirteenth day, when the enteric inflammation was at its height, and very soon the pneumonic symptoms superseded the enteric. This is precisely what occurs so often in the worst cases of enteric fever, and but for the post-mortem examination of the body, or I should rather say of the lungs, the present case would have been regarded as typical of enteric fever, attended with pneumonia.

CASE 8.—*Acute tubercular meningitis and pneumonenteritis, with ulceration of Peyer's patches; death on the eleventh day from the supervention of febrile symptoms, probably the fourteenth or twenty-first of the disease.*

Marian Snow, æt. 3½, admitted on the fifth day of a febrile attack.

5th day.—Pulse 120; tongue moist, with a white fur; skin hot; cheeks with a deep circumscribed blush; drowsiness.

6th day.—Pulse 84; temp. 99·6°; was still drowsy; pupils equal, ⅛″.

7th day.—Pulse 84; skin cool; had a more lively expression and protruded the tongue when asked to do so; it was moist and only slightly coated.

8th day.—Not so well; pulse 116; drowsiness increased; cheeks with a patchy flush; drank badly; inequality, but free mobility of the pupils.

10th day.—In a semicomatose state, with the eyes half closed; pulse 120; pupils equal; skin hot and cheeks flushed; refused to swallow. The bowels had acted naturally throughout, and to-day the motion was solid, but it was passed involuntarily. The little patient sank the next day. The body was *well developed and fairly nourished. The brain*, excepting the upper part of the cerebral lobes, was unduly soft, and there was more than the normal amount of fluid in the ventricles. The arachnoid lying between the cerebrum and cerebellum, and, in a less degree, the choroid plexuses, were studded with small white tubercles a little larger than pin's heads. The *left lung* and pleura were healthy; the visceral layer of the *right pleura* was studded with white tubercles the size of hemp seed; the *lung* itself weighed five ounces and was bound by old adhesions behind. The upper lobe was healthy; the middle was adherent to the other two by old adhesions, and it was stuffed internally with sago-like grains of tubercle; the lower lobe was in the same condition, and contained just within its anterior margin a hard round

mass of caseous tubercle the size of a marble. One of the bronchial glands had undergone a similar degeneration, and the cheesy matter was enveloped in a semi-cartilaginous capsule. The *mesenteric glands* were pale and large, and those about the junction of the large and small intestines formed a heavy knotted mass. A few small nodules of formed bright yellow fæces were washed from the bowels The whole of *Peyer's patches* were injected and swollen, those in the lowermost part of the ileum formed cockscomb-like processes; the rest were more or less ulcerated, and many of the ulcers appeared to be in process of healing. A large Peyerian gland three feet from the valve had several small rounded ulcers, and one of them had penetrated to the peritoneum, and caused inflammatory adhesion of the part to a contiguous coil of intestine. The other organs were healthy.

This case illustrates the not uncommon fact that there may be serious ulceration, even to impending perforation of the ileal glands, without any appreciable indication of this condition. The lung and bowel mischief had probably been latent for two or three weeks; decided febrile symptoms appeared to have arisen at the time when the brain became implicated in the general tubercular deposit.

CASE 9.—*Acute pneumonenteritis in a tubercular subject; death on the twenty-ninth day, chiefly from peritonitis, caused by one of the intestinal ulcers.*

John Cash, æt. 14, admitted 28th June, 1870, on the twenty-first day of his illness, which, for the first nineteen days, amounted to nothing more than sickness after meals, headache, and languor, but the last two days there had been profuse diarrhœa and delirium.

22nd day.—Pulse 130. Tongue dry and wrinkled at the centre. Bowels still loose. One or two doubtful rose spots.

23rd day.—Pulse 140. Active congestion of the lower lobes of the lungs. Bowels very loose.

24th day.—Pulse 144, respiration 36. Occasional dry cough. Right chest dull in front. Fine crepitation and bronchial breathing over the whole of the lung. Two loose stools.

25th day.—Pulse 136, resp. 38. Fine crepitation over the upper half of the left lung in front. Delirium, sordes, and diarrhœa.

During the next four days the pulmonary inflammation and prostration increased. There was no expectoration, and the bowels were open once a day, and on the twenty-seventh day the stool was reported "natural." The pulse ultimately rose to 156, and the respirations to 60, and he died on the twenty-ninth day. One or two fresh rose spots appeared at intervals.

The body was rather fat and the frame large. The *right lung* was bound to the chest by very strong old adhesions in front, and by slight ones at the apex and

behind. It was in the first stage of molecular pneumonia, and only faintly crepitant. The apex was wrinkled by pea-like masses of old tubercle, lying near the surface, and surrounded by tough, carnified lung-tissue. The apex of the *left lung* was shrivelled, puckered, and knotty, obviously having been the seat of a tubercular cavity. The rest of the lung was healthy, but the lower part was engorged. There was severe peritonitis arising from a vascular spot upon the *ileum*, nine inches from the cæcum. There were rather hard masses of bright ochre-coloured fæces in both large and small intestines. *Peyer's patches*, for the most part, were gravely ulcerated throughout the ileum. The ulcers were red and angry looking, not much raised, and usually invaded only a part of the gland tissue in an irregular manner, so as to leave islands and processes of unaffected gland structure, which had the shaven-beard appearance. One of the ulcers lay on the peritoneum and caused the peritonitis, which glued the pelvic coils of intestine together, and covered them with solid granular lymph and pus. The solitary glands near the valve formed yellow elevations. The *mesenteric glands* were greatly enlarged and very vascular. The *spleen* weighed four ounces, and the *gall-bladder* contained a little thin, orange-coloured bile.

Case 10.—*Acute and very severe tubercular pneumonenteritis; typical symptoms of enteric fever from first to last; death from prostration on the twentieth day.*

Charity Garner, æt. 15, admitted on the eighth day (February 1st, 1870) of a febrile attack, which began with a severe chill and loss of appetite, followed by diarrhœa. She had been remarkably healthy previously.

8th day.—Pulse 116; skin hot and dry. Tongue moist at the edges, dry, red, and cracked in the centre. Face flushed. Eight or nine rose spots on the abdomen. Bowels loose.

9th day.—A few fresh spots. Three loose dark-coloured stools.

10th day.—Pulse 104; moisture on the wrists. Three fresh spots. Four loose ochre-coloured stools. A little sordes and delirium.

The disease progressed during the following days, the rash coming out each day. The abdomen became full, painful, and tender, and she was reduced to a typhous[1] condition.

On the 19th day there was extreme prostration and apathy, the pulse was 160, the tympanitic distension of the abdomen was increased, and the motions were frequent and watery. She died next day.

The body was finely developed, and there was a layer of fat on the abdomen three quarters of an inch thick.

The *large intestine* was healthy. The *ileum* was severely congested, and the last twenty-six inches was the seat of intense inflammation, all the *glands, agminate* and *solitary*, being in a state of ragged ulceration, some with grey or black sloughs, but the majority were stained yellow; the edges of the widely spread ulcers were dusky purple, almost bleeding, and raised a quarter of an inch above

[1] The author uses this term instead of "typhoid," which should now become obsolete.

the mucous membrane. One ulcer lay on the peritoneum; above this, Peyer's patches were but slightly congested, but the whole of the solitary glandulæ were as large as hemp-seeds, very turgid, and of a vivid purple-red colour. Still higher up the solitary glands were in a state of simple psorentery, forming white prominences in the mucous membrane. The corresponding *mesenteric glands* were purple, and as large as walnuts. The *spleen* weighed twelve ounces; it was of normal consistence.

The *liver* was large, doughy, and greasy, weighing four pounds seven and a half ounces. The gall-bladder contained two drachms of watery, yellowish-brown bile. The *kidneys* were large, weighing together seventeen ounces; they were congested, but otherwise appeared healthy. There was only one *ovary*, which was healthy, and double of the normal size.

The *lungs* were of the consistence and dark-purple colour of the spleen, and the lower lobes were thickly strewn with fine grains of greyish-white, tubercular deposit, which gave to the sections a very marked mottled appearance. The contiguous parts of the superior lobes partook of this condition, but the deposit gradually disappeared above, and was absent from the summits, which were merely in a state of active red engorgement, and still retained some crepitancy. The bronchial glands were dark purple and greatly enlarged.

The *pleuræ* were healthy, but, as the tubercular deposit could be felt through the membrane, the surfaces of the lungs were granular to the touch.

The *heart* and *brain* were healthy.

In this patient the intestinal lesions were absolutely typical of the worst forms of enteric fever, and the lungs as absolutely typical of tuberculosis.

The only pulmonary symptom throughout was hurried breathing, such as is commonly called nervous. The patient was in too critical a condition to bear the disturbance which an examination of the back of the chest required.

The so-called nervous breathing in enteric fever is usually dependent upon active pulmonary congestion, as is exemplified in this case.

It may be assumed that both bowel and lung mischief arose simultaneously on the day when the patient took cold.

Case 11.—*Acute tubercular meningitis and pneumonentritis; death from meningeal inflammation on the twentieth day.*

Emily Chaffers, æt. 11, admitted 18th April, 1870. She was a healthy lively child before her illness, which began suddenly with rigors followed by severe vomiting and purging.

8th day.—Pulse 92; skin hot and dry; tongue white and moist.

9th day.—Pulse 108, one liquid light-coloured stool. Abdominal tenderness.

11th day.—Pulse 102; no action of the bowels for thirty-six hours; vomited a little green bilious fluid.

16th day.—Pulse 112; tongue moist and slightly furred. Slight ptosis and external strabismus on the right side; return of vomiting. Abdomen collapsed; bowels confined.

17th day.—Wandering and moaning almost constantly, and when aroused complained of pain in the head and arms; conjunctiva much injected; persistence of right ptosis, and wide dilatation ($\frac{1}{3}''$) and insensibility of the right pupil. A simple enema was followed by a natural stool.

The nape and subsequently the shaven head were blistered, but she gradually grew worse and died on the 20th day. Two days before her death the left pupil was contracted and active, the next day the pupils were equally dilated and fixed, she was semi-comatose, occasionally crying out with pain in the head. The previously constipated bowels were again loose, and both fæces and urine were passed involuntarily; the body was moderately well nourished. *Under the right parieta bone* for an area of three square inches there was a deposit of miliary tubercle in the white lymphy arachnoid; great venous congestion of the brain; and distension of the ventricles with clear fluid. At the base of the brain, from the optic commissure to the pons, the nerves were surrounded by a thick matting of lymph, and the third of the right side seemed to be constricted by a cord of firmer texture than the rest. There was a limited deposit of tubercle in the summits of *both lungs;* in one the deposit was partly cretified. The *spleen* and *mesenteric glands* were moderately swollen, the intestines were empty, *Peyer's patches* were generally congested, and two or three of those on the lower part of the ileum were the seat of small, round, pale ulcers.

Very many cases of enteric fever begin thus suddenly, probably from severe chill. The vomiting and diarrhœa at the outset, no doubt, marked the deposit of tubercle in the ileal glands, and just as pneumonia sometimes supersedes the enteric symptoms, so in this patient did the indication of brain mischief take the precedence, and during the latter half of the illness the meningeal inflammation appeared to be the sole affection.

CASE 12.—*Scarlatina* (?) *followed by acute tubercular meningitis and pneumonia; death from effusion into the cavities of the brain on the 33rd day.*

Wesley Bartlett, æt. 6, admitted on the 30th day of a fever of which no history could be obtained, but the father died this day.

30th day.—Pulse 100; skin hot and dry, with slight desquamation and faint injection over the trunk and extremities. Face pale. Tongue moist with a thick yellowish fur. Abdomen retracted; one rather loose light-coloured stool. Some noisy delirium and restlessness.

31st day.—Pulse 108; the next day 156; occasional screaming. To-day the left eyelid became tumid and drooping with wide dilatation of the pupil, which was, however, directed forwards. Tongue dry, clean, and red.

32nd day.—Pulse 140; Resp. 20, sighing and irregular, sometimes an interval of five seconds between the inspirations, which were accompanied by a sucking sound. Sibilant and subcrepitant râles heard all over the chest: an occasional cough. Retention of urine.

The little patient died comatose on the following day. The body was much emaciated; the urinary bladder was distended with healthy urine.

The meninges were severely congested; tough solid lymph was effused at the base of the brain between the crura cerebri, involving the 3rd nerve of both sides; the effusion thinned away over the pons and medulla; the ventricles were distended with clear pale serum.

The lungs were fully inflated, each weighed 8 ounces and each was speckled with miliary tubercle, the intervening lung substance being dark red. The *pleuræ*, the *spleen*, the *mesenteric glands* were quite healthy. A firm white clot occupied the cavities of the right heart. *Peyer's patches* were slightly red and swollen here and there.

No doubt the inflammatory products in the brain were identical in character with those in the lungs, and as these were in the form of miliary tubercles, so we must conclude that the meningitis was tubercular. Indeed, the symptoms and post-mortem appearances are those of the majority of cases of tubercular meningitis.

Case 13.—*Acute tubercular meningitis and pleuro-pneumonenteritis; death on the twenty-third day from effusion into the cavities of the brain.*

Henry Manning, æt. 11, admitted Dec. 20th, 1866, on the 22nd day of his illness, which commenced with fever and diarrhœa, and afterwards presented the ordinary symptoms of enteric fever; latterly there had been much delirium.

22nd day.—Was quite unconscious and tossed the head about continually; the eyes were closed and the pupils dilated, the left one more so and fixed. The pulse was rapid and almost imperceptible; the tongue moist and covered with a thick fur; the temperature high; the abdomen flaccid and the bowels quiet. The patient sank and died the following day. The body was spare but well developed. *The membranes* at the base *of the brain* were severely inflamed and a layer of toughish yellow lymph covered over the pons and the parts in front as far as the optic commissure; the ventricles were distended with yellow serum. *The brain* was congested and the left optic thalamus decidedly swollen, but the substance throughout appeared healthy. *The pericardium* was full of fluid, but the surfaces were quite smooth. *The lungs* weighed 29 ounces; both were everywhere adherent by friable organizing membranes; the apices were solidified by greyish-yellow,

tubercular deposit the size of hemp seeds; the lower lobes of both were engorged red, and tough. *The liver* was attached to the under surface of the diaphragm by new adhesions similar to those between the pleura; it was healthy and weighed 29 ounces. *The gall bladder* contained half an ounce of thick healthy bile. *The spleen and mesenteric glands* were purple and swollen. The pale intestines contained formed healthy fæces. Several *Peyer's patches* in the last four feet of the ileum were red and swollen, and several more in an angry state of ulceration; the ulcers were dark purple, raised and with irregularly contracting edges. The patches about the valve formed one continuous surface of ulceration.

In this case, again, the meningeal exudation was molecular and not tubercular.

I conclude with a few words as to the relative frequency with which the inflammatory products assume the tubercular and molecular forms respectively in enteric fever. In cases 1, 5, 6, 7, 8, 9, 10 and 11, above described, the symptoms were those of the worst forms of enteric fever, and during life the cases were regarded as such. In the interval of their occurrence 307 cases of enteric fever came under my care. Of these 51, or about 17 per cent., died. Of the fatal cases I made 43 post-mortem examinations, and 8 of these, or 18·7 per cent., were the cases above referred to. But inasmuch as tubercular, exudation is necessarily more fatal than the molecular form, this is too high a number, and in reference to the whole number of cases of enteric fever it would probably fall to less than half. Still it is a very noteworthy fact that 8 or even 5 per cent. of ordinary cases of enteric fever may be associated with the deposit of tubercle.

Since our prognosis will be affected to a certain extent by the form of the deposit, it becomes a matter of practical importance to determine whether it is assuming the tubercular or molecular form.

When the ileal glands alone are affected the distinction between tubercular and enteric fevers is absolutely *nil*, but there is usually more or less pulmonary complication; then a diffuse noisy crepitation in a considerable portion of a lung is to me a mark of tubercular deposit. Thus during life as well as after death the distinction will generally be carried back to that which subsists between tubercular and simple pneumonia. For further observations on this topic I must refer the reader to my article on enteric fever in 'Reynolds' System of Medicine.'

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FÆCAL RETENTION, ESPECIALLY AS IT AFFECTS THE CÆCUM.

By JOHN HARLEY, M.D. Lond.

Constipation is often the forerunner of enteric fever, and so far may be regarded as a factor of that disease.

I believe I may go even further and state that constipation is occasionally the sole cause of enteric fever.

Those who regard this disease as specific will not, of course, assent to this proposition, but they are compelled to admit that simple enteritis, more or less general, may be a consequence of constipation, and the question is thus resolved into the identity of simple and so-called specific enteritis. I have long ago[1] admitted, if not proved, the identity, and therefore must needs call attention to this point in the present communication.

There is of course no morbid condition more frequently witnessed than constipation. A retention of the contents of the colon for forty-eight hours is sufficient, in some persons, to render the fæces hard and lumpy; and there are hosts of people who think they pay proper attention to the wants of nature if they unload their bowels once in two or three days. Nor is the number of those who habitually go a week very small. While constipation is the commonest ailment that comes under our notice, how rarely do we seem to trace it to a fatal issue,

[1] "Enteric Fever," 'Reynolds' System of Medicine.'

and to study its effects after death? "seem," I say, for I am convinced that many a fatal attack of enteric fever has its origin in constipation.

Nor is death from simple idiopathic constipation a very common event. I can myself adduce two instances from my own practice, and show from a number of others how soon matters assume a grave aspect when the bowels are allowed to become slowly impacted with fæces.

In order to trace the effects, both local and constitutional, of constipation, I will briefly give the history of three cases which will serve to illustrate the condition.

Case 1 is that of an elderly lady who had resided for many years in India; she came under my care during the last thirteen years of her life, and died at the age of seventy-nine of an attack of constipation. Throughout life she was satisfied if her bowels acted twice or thrice a week, but when away from home, or if there was the slightest risk of her privacy being disturbed, she would allow a week or longer to elapse before she got relief of her bowels. She led an active life, walking a good portion of each day, and as often as she felt bilious took a colocynth pill and so got what she regarded as sufficient relief. As she grew older and less capable of exercise, the bilious attacks became more frequent and violent, and then it was that my aid was sought, and I learned from her maid the real state of affairs, namely, that her mistress usually went to the closet only once a week, that her motions were always scybalous, and that when matters came to a climax and strong purgatives were used, a vast quantity of lumpy fæces were discharged. "Do, sir, get mistress to pay more attention to her bowels, for these attacks make her dreadfully ill; and I am sure she will do herself harm by neglecting herself in the way she does," was an appeal which her intelligent maid made to me more than once. The patient herself, however, thought but lightly of the matter. She as good as told me that once a week was often enough to attend to such a disagreeable duty; and when I suggested the occasional use of an enema; "Don't mention such a thing again," she said, "I would rather die than use it. Give me any medicine excepting castor you like, and I will take it."

Such was my patient. Whenever a repetition of the usual pill failed to remove the obstruction, she was attacked with bilious vomiting, and from the quantity discharged it was evident that the amount of unused bile retained was somewhat commensurate with that of the retained fæces. The vomiting of bile usually continued uncontrolled for twenty-four hours, and was, of course, attended with great prostration. The usual remedies were five to ten grains of calomel with half a grain of opium, and an effervescing draught of citrate of soda and hydrocyanic acid, at intervals. A little iced brandy and water was the only sustenance that could be retained, and this was as often rejected as not. As soon as the bowels were relieved the attack subsided.

The attacks recurred pretty regularly at intervals of three or six months, and on one occasion calomel, and subsequently a large dose of compound colocynth pill, failing to open the bowels, I said "My only safe resource is the enema." I explained its simple, direct action, and the danger of forcing a passage from above. She shook her head, smiled, and said, "Give me a good dose of Croton oil, that I know will be effectual." I was obliged to yield, and fortunately the result was satisfactory.

I now provided the maid with an india-rubber enema apparatus, showed her the use of it, and urged her to get her mistress to use it. But the lady's conservatism and abhorrence of everything that savoured of French customs got the better of her own sound judgment and of our entreaties; and it was only in her last attack, and a few hours before her death, that I disregarded her scruples, and for the first time washed a few large scybala coated with fluffy mucus from the rectum. But this time the vomiting caused rapid prostration, and she was "*in extremis*" and died unrelieved of her constipation about ten hours after the commencement of the attack.

Case 2 will serve to illustrate a passive variety of the same condition. The subject was an old servant of my own, a little spare woman, nearly seventy years of age. I was once asked to see her, and found her in bed, prostrate, with a dry brown tongue and a pulse of 80. She could give me no

further account of herself than that she had completely lost her appetite, and was too weak to go about her work. She looked, indeed, as if she were going to have typhus fever, but the skin was cool and free from rash. On examining the thin abdomen I could distinctly feel nodular fæces, and then I discovered that she was habitually constipated, and that the bowels had not acted for seven or eight days. A clyster of soap and water followed by a dose of castor oil brought away a large quantity of scybalous matter, and she was well again in the course of a few days, but continued weak for several more. During the time she was in my service she had three such attacks, exactly similar, the dry brown tongue being very characteristic. I prescribed an aperient pill, giving her warning not to neglect the action of the bowels, and she has followed my directions and experienced no more attacks. She is still living near the age of eighty.

These two cases illustrate the difference in the symptoms which attend the same condition in different individuals. The one (Case 1) was an excitable, highly emotional person; the other was of a placid disposition, and had no tendency to vomiting.

Such an individual it appears was the subject of Case 3, who actually died of constipation without any indication of obstruction.

Case 3. *Fatal constipation without prominent symptoms.*—Charles C—, æt. 17, was admitted moribund into the London Fever Hospital, 13th November, 1866. No history could be obtained of him, except that he had been very weak and "out of sorts." His body was spare almost to emaciation, the skin supple, free from rash, and cold, the hands and feet dusky, the eyes sunken, the pulse thready, the tongue moist and dirty; the abdomen was not enlarged, and it had a doughy, inelastic feel. He was free from pain or distress—apathetic, indeed—and took drinks with difficulty. He did not rally, and died next day.

After death.—The small intestine was found void of fæcal matter, the mucous membrane everywhere injected and covered over with a layer of purulent-looking mucus, the sur-

face beneath was red, vascular, bare, and in patches considerably inflamed. The whole of the large intestine, from the opening of the vermiform appendix to within two inches of the anus, was impacted with fæces; in the colon formed into tripartite masses, each lying in a separate cell, and only attached to the mass above and below at the centre, where it was three quarters of an inch thick. The colon was contracted on these scybala so as to have a very regular nodular appearance. The cæcum was filled with one large mass of very stiff, dark-greenish fæces, weighing about a pound. On raising the scybala from the mucous surface, this was found to be vascular and covered over with a thick layer of yellow opaque mucus, and at some parts, in the cæcum especially, the mucous membrane was much inflamed. All the other viscera were healthy.

Here is a case in which constipation set in gradually, attained its fullest development, was, as far as could be ascertained, wholly uninterfered with, and was thus allowed to run its fatal course. Let us consider the effects, both local and general, which are consequent upon such a condition.

The earliest effect of constipation is the absorption of moisture, and the conversion of the soft fæces into lumps or nodules. A considerable amount of mucus is secreted and incorporated with the fæces as a normal process, and it would appear that there is no diminution of the amount of mucus thrown out when the fæces are retained, for one of the most obvious effects of constipation is the formation of a thick layer of opaque mucus upon the surface of the scybala, filling up the interstices between the nodules, and when placed in water seen as a thick fluffy coating. Such a layer of mucus no doubt acts as a protective covering, and at the same time, by obstructing osmosis, prevents the absorption of fæcal matter. But retained mucus is itself liable to putrescent change. Ozæna, for example, is commonly produced by the decomposition of retained mucus; it becomes opaque and purulent, and then very soon disorder arises in the germinating layer, the blood-vessels become congested, growth ceases, the mucous membrane softens, and the unhealthy surface easily bleeds and soon presents patches of erosion. If this state of unhealthy congestion of the mucous membrane be not relieved by the expulsion of

the unhealthy contents of the bowel, irritation and pain sooner or later ensue, as the immediate forerunners of inflammatory action. It is but reasonable to expect that lymphatic irritation would arise very soon in such a condition as this, and thus the solitary and agminated glands would be involved, when the symptoms would be indistinguishable from those of developed enteric fever. I could adduce several instances of this transition, but I will content myself with the following case, which will easily be recognised as a link in the chain:

Case 4. *Fæcal accumulation in the cæcum inducing some of the symptoms of enteric fever.*—James R—, æt. 40, a large, rather fat man, a policeman, was admitted into the London Fever Hospital, 8th June, 1871, on the fourteenth day of his illness. He gave the following account of himself:—The day before his illness commenced he accommodated a colleague, who had just left the Fever Hospital convalescent from an attack of relapsing fever, with a bed, and was disgusted by a bad smell arising from his clothes. Next day, when on duty, he felt an icy chilliness and pain in the legs. On the second day he had pain in the abdomen, and he applied to a medical man who gave him pills "to work it off." The pills acted, and he continued on duty until the ninth day, and then took to his bed, where he remained until the day (fourteenth of the illness) of his admission. At this time there had been no action of the bowels for ten or eleven days. The mind was clear, tongue moist with an even coating of white fur, the skin coldish and free from rash, pulse 100 and weak. There were pain, tenderness, and fulness in the right iliac fossa; the rest of the abdomen was rather doughy to the feel. There was anorexia, but he took fluids. Hot fomentations were applied and stimulants administered. Excepting a pain in the right gluteal region, extending to the knee, and very free perspiration with beads of sweat on the forehead, he continued in the same state.

On the sixteenth day half an ounce of castor oil was given; it acted once moderately. On the eighteenth day the pulse was 120, the temperature only slightly elevated, the skin free from rash and still perspiring, the tongue still moist with a dirty-white fur. A simple enema produced two loose stools, the first containing scybala. The next day (nineteenth) a

defined, hard, tender tumour, in which the patient experienced some throbbing, could be felt in the cæcal region, the fulness and solid feeling passing upwards to the hepatic region. A light loose stool was discharged spontaneously to-day. He was now ordered daily enemata of castor oil and the continued application of linseed and mustard poultices to the right iliac region. The first enema produced a loose yellow stool with a few hard scybala as big as filberts.

On the twentieth day the throbbing had ceased, the abdomen was less full, and now the tumour in the cæcal region was appreciable to the eye, lying in the iliac region; it was firm and not very tender, and reached, on the left side to within two inches of the mesial line upwards; to the hepatic region, and downwards two inches below the level of the anterior superior spine of the ileum. The breath had a disagreeable sweet odour.

During the next two days there were eight or nine loose stools—a very copious relief. These evacuations consisted of disintegrated fæces, being thin and yellow without scybala.

On the twenty-second day a great diminution of the fæcal tumour was noticed, and manipulation gave very little pain.

On the twenty-third day there was a marked improvement in the general condition, and the tumour was no more perceptible than the sigmoid flexure before a natural evacuation. The tongue was still covered with a thick white fur, the skin was cool and occasionally perspiring very freely; the patient was comfortable but feeling weak.

During the next few days the enemata continued to bring away large quantities of fæcal matter, and this part of the treatment was now finally omitted.

On the twenty-eighth and thirtieth days a very copious semisolid stool was discharged each day, the tongue began to clean, and the appetite to reappear. Fish was allowed, but it appeared to provoke diarrhœa and was discontinued next day. Perspiration was still profuse, the abdomen retracted, and the cæcal tumour quite gone. The bowels continued loose for the next seven days, two or three stools in the twenty-four hours, the motions being watery and light yellow.

This outbreak of diarrhœa was preceded by the appearance of a few rose spots upon the trunk on the thirty-second day.

At the end of a week the motions acquired a natural consistence, and there was no further development of rash after the thirty-second day. Perspiration still continued profuse at times, and the pulse declined to 84. The patient was very weak, and there was considerable emaciation. It was the forty-seventh day before the appetite returned and he was able to take solid food. He regained his strength slowly, and was discharged on the sixty-fourth day.

In this history we see some things which resemble enteric fever and some that do not. As resemblances I may point to :—1. The onset—disgust of a bad odour. 2. The long continuance of the symptoms (two months and more), and the prostration and emaciation attending them. 3. The development of a rose rash.

The differences appear at first sight even more positive: 1. There is a large fæcal accumulation with constipation. 2. An absence of fever, the temperature never rising beyond 99°, except on the day after his admission when it was 101°. 3. A moist skin frequently bathed in sensible and distressing perspiration. 4. A continuously moist tongue. 5, and lastly, the need of a purgative treatment.

Those who are fond of classification—artificial distinctions, I would rather call it—will perhaps be quite satisfied that the case I have narrated in brief above is not one of enteric fever. But when we come to analyse these resemblances and differences we find that they have no real worth. Thus a squeamish stomach is surely to be expected when the bowels are blocked and the appetite gone. Prostration with emaciation is an invariable attendant on enteric fever, and must be regarded as the direct result of arrest of nutrition. But such arrest of nutrition would equally happen in a case of grave constipation such as the present or Case 3, which is even more to the point.

A successive crop of rose papules appearing daily for three or four days occurs in considerably less than half the cases of enteric fever, and it must be granted that in many cases the rash when present does not amount to more than was noted in the case recorded above. For my part I cannot regard this as very important evidence of the existence of enteric

fever, but I would say of this symptom as of the rest, "*valeat quantum valet.*"

As to the differences. A reference to the history of the case will show that constipation persisted, or that enemata and purgatives were required, up to the thirty-second day; then a few rose spots appeared, and the bowels became loose—two or three light yellow stools in the twenty-four hours—and continued so for a week. But constipation—I will not say to the extent of a large palpable fæcal mass—is a very common event in enteric fever. Indeed, if I look back to the cases which have occurred in my practice during the last three or four years, I find several cases in which enemata have been required throughout the attack, and in the majority they have been needed in the early as well as in the convalescent stage of the disease. Constipation, therefore, affords no distinction. In the case narrated the pain produced by pressure of the lumbar plexus is significant of the amount of the accumulation.

Perspiration, excepting as a crisis, is certainly not common in enteric fever; but to mention only one instance, I have this winter treated a severe case in Arthur Ward in which frequent and severe sweats were for three weeks a distressing symptom.

The only real distinction which remains is in respect of the temperature. Normal temperatures have indeed been noticed in attacks of enteric fever, but like continuous perspiration they are the exception.

Thus between two groups of symptoms, the one produced by fæcal accumulation and obstruction and the other by the cause of enteric fever, we fail to find any essential distinction.

The connection between the two morbid conditions may be shown to be still closer. In the case of constipation while the cæcum was full there was anorexia. As soon as the obstruction was removed the appetite returned, but the fish that was then taken provoked diarrhœa. The mucous membrane was still thin, bare, irritable, congested, not to say excoriated, and ready to resent any annoyance.

If the fæcal matter had been allowed to remain undisturbed in the intestine for some days longer, severe febrile symptoms would no doubt have been developed, and then probably the case would have been regarded by all who saw it as one of enteric fever.

I pass now to make a few remarks *on the treatment of fæcal retention involving the cæcum.* The subjects of it are numerous. The condition itself is very often regarded as typhlitis and perityphlitis.

I have at the present time two patients in St. Thomas's suffering from this affection, and a brief account of these will serve to illustrate the treatment.

In these, which may be taken as typical cases, the accumulation in the cæcum was but a part of the general constipation. The first object of treatment was to unload the colon by the use of saponaceous and oleaginous enemata, given at intervals of six or twelve hours according to urgency. After the evacuation of a fair amount of fæcal matter has been thus elicited, I give half an ounce of castor oil with two teaspoonfuls of brandy, and eight or ten minims of tincture of opium, and repeat the dose after every evacuation produced by the enemata. By these means we may succeed in producing two or three fæcal motions in the twenty-four hours to the great relief of the patient. The fæcal tumour will be found to decrease and become less tender from day to day, and in cases of ordinary severity the cæcum will be emptied in the course of a week, and the patient restored to convalescence. Where there is much pain, a hot linseed and mustard poultice should be kept applied to the abdomen.

The subsequent treatment should be that of enteric fever, and for a week at least after all pain and febrile disturbance have ceased, no solid food should be given.

If the case have been a severe one and the symptoms of long continuance, as in No. 4, there is commonly a tendency to reaccumulation in the cæcum. To avoid this, an occasional dose of castor oil should be given, a compress worn with a flannel bandage over the region of the cæcum, and frictions occasionally used over the part; strychnia in some tonic infusion may be given to promote tone in the weakened intestinal wall.

Inveterate paralysis of the large intestine sometimes follows an attack of constipation, the colon becomes distended with air to an enormous size, its flexions can be traced by the eye, and there is much difficulty in securing the evacuations, which are formed into clay-like balls often as large as

the patient's fist. Two such cases have come under my notice.

But to return to the ordinary cases :

Case 5. *Gradual constipation followed by the sudden appearance of symptoms of obstruction in the cæcum.*—Louisa B—, æt. 19, a stout, healthy domestic servant, was admitted into Christian Ward, 18th March, 1882. She had never had illness until eight days before, when she was taken with vomiting and pain in the right side of the abdomen; there was complete anorexia, frequent chilly sensations followed by heat. These symptoms, including the vomiting of green bilious fluid, continued up to the time of admission. The bowels she said had acted regularly up to the first day of her illness, and she was obliged to take to her bed on the fifth day.

On admission on the eighth day the cheeks were flushed, temp. 102·2°, pulse 104, tongue coated with white fur, red at edges, inclined to become dry, much pain and tenderness in the right iliac fossa, and resistance of the rectus. The bowels had not acted for a week.

A simple enema brought away a very copious natural evacuation. A grain of opium was given by the mouth and a linseed and mustard poultice applied to the abdomen.

Ninth day.—A diaphoretic mixture, every four hours, and five grains of Dover's powder with two grains of mercury and chalk, night and morning, were prescribed.

Tenth day.—Improved, temperature declined to 100°, pulse 84, pain and tenderness much less, and she bore palpation fairly well. A well defined solid rounded tumour was felt lying in the iliac fossa and extending vertically to the liver and towards the left to about two inches from the mesial line. A simple enema was now given every day and followed by half an ounce of castor oil with eight minims of tincture of opium, and continued until the seventeenth day, when the bowels acted spontaneously and freely this and the following day.

On the nineteenth day another dose of oil and laudanum was given; two days afterwards the previous medicines were omitted and quinine mixture prescribed.

On the twenty-third day she was convalescent and left her bed.

On admission the patient had the aspect and general symptoms of enteric fever, but the accumulation in the cæcum was evident. Her statement that the bowels had been acting regularly up to the time of her admission was no doubt correct, for a gradual accumulation of fæces in the cæcum is quite consistent with a daily action of the bowels. Young people are not usually particular in ascertaining the quality and amount of their evacuations, and if they have a movement of the bowels every day they regard that as satisfactory whether large or small.

As to the progress of the case, this was uniformly satisfactory, the temperature declined and was normal after the sixteenth day. The evacuations were copious and consisted of normal broken down fæces without scybala. The cæcum was still full and tender on the fourteenth day. On the sixteenth day tenderness was absent, and on the eighteenth day it was wholly relieved of its contents, and felt like a movable cord beneath the now lax abdominal wall. Desire for food returned on the sixteenth day, and she was allowed fish on the seventeenth day, and left her bed on the twenty-third day.

Case 6. *Constipation, acute pain in the right iliac region, and vomiting after a hearty meal of whelks; fæcal tumour of the cæcum; convalescence after twelve days.*—Henry B—, æt. 25, a strong, healthy, well-nourished man. He never had any illness like the present, and admitted that he had paid little attention to the action of his bowels.

On the 18th of March he ate heartily of whelks, and some hours afterwards was suddenly taken with severe pain in the abdomen and vomiting of a green fluid. He was admitted into Arthur Ward early next morning. The temperature was 101·4°, he lay on his back with the legs drawn up, and had much pain and tenderness in the right iliac fossa, which appeared a little fuller than the left. The rectus was very resistant, and the part was too painful to bear handling. The bowels had not been open for several days. Hot poultices were applied, simple enemata given every three hours, and a grain of opium by the mouth. In the afternoon the temperature rose to 102·2°. Four or five dark fluid motions without scybala were elicited by the enemata. In

the evening half an ounce of castor oil with eight minims of tincture of opium was given by the mouth. Bilious vomiting however recurred, and as this dose was probably rejected, another was given, which was followed in the course of a few hours by a very copious evacuation of a somewhat pasty consistence and dark yellowish-green colour.

Third day.—There was a little relief of the abdominal symptoms, but he still lay on the back with the legs drawn up; the loaded cæcum, still very tender, could now be distinguished; temperature 101°, pulse 100, tongue moist, with a thin white fur. A simple enema, followed by a dose of castor oil (℥ss) and laudanum (♏viij), was given daily for the next week. The evacuations were free, composed of light yellow disintegrated fæces with a few hard lumps the size of nuts.

On the sixth day the cæcum was much less tender, it was still full, and distinctly nodular to the feel. After this date the improvement was rapid, and by the twelfth day the accumulation was completely removed, the bowel could be handled freely, and it was contracted to a soft rope-like band. Between the third and ninth days the temperature was usually about 1° above normal, being 100° on only one occasion. Afterwards it declined and remained normal.

He was allowed fish on fourteenth day. Convalescence was uninterrupted, and he left the hospital on the 21st day.

In this case there was pre-existing constipation, and the ingestion of a hearty meal of indigestible food developed the symptoms of the latent obstruction by causing the descent of more fæcal matter into the cæcum when already over-charged. The symptoms arose soon after a meal, the usual provocative of peristaltic action in the digestive tube.

So far I have only spoken of constipation as it affects the mucous membrane, and I exclude the foregoing cases from the condition which is commonly designated typhlitis.

Inflammation of the whole of the coats of the cæcum must result as a matter of course whenever retention remains long unrelieved. To make my paper more complete I will therefore add two more cases, one in which incipient inflammation probably involved the cæcum, and another in which inflammation passed into ulceration and perforation.

Case 7. *General constipation; retention of fæcal matter in the cæcum, fever, local pain and constipation.*—Eliza S—, æt. 19, a healthy, well-developed girl, had been poorly, and attending Queen Charlotte's Dispensary for headache for some weeks. The bowels had been acting every other day, and she was doing her ordinary work, when on 17th September, 1871 (first day of her illness), she was taken with a sudden pain in the right side of the abdomen with vomiting. The symptoms continuing, she was admitted into the London Fever Hospital, Sept. 21st. When I saw her the bowels had not acted for eight days. She complained of much pain in the iliac and lumbar regions of the right side, the cæcal region was full and very tender, and occupied by a smooth rounded mass lying between the anterior superior spine of the ileum and the costal arch. Pulse 120, temperature 104°. The skin injected and dry, the cheeks flushed, tongue moist, furred with red edges. A few hard nodules (scybala) could be felt in the left iliac region. A simple enema, and half an ounce of castor oil by mouth were given immediately, and these were followed in the course of a few hours by two very large motions, composed in part of healthy soft fæcal matter and in part of rounded scybala the size of walnuts, and of the consistence of moderately soft cheese. Hot fomentations were applied. This was followed by relief of pain and sickness.

On the eighth day of the illness (the eleventh since the primary constipation) an enema of castor oil and turpentine (of each an ounce) was given. This returned without effect.

Twelfth day.—Pulse 106, temperature 102°, tongue as before moist, the dorsum with a thick dirty yellow fur, the margin red; the abdomen a little full, everywhere soft, resonant, free from tenderness, excepting on the right side, which is still occupied by a vertical tumour, whose rounded border lies two and a half inches to the right of the median line. She could not bear the slightest pressure. Six leeches were applied over the cæcum, and half an ounce of castor oil given by mouth. The bowels were freely relieved of much firm, healthy fæcal matter, and were subsequently loose for twenty-four hours. Next day the tumour was considerably less and the general condition improved.

On the fifteenth day the flush was gone, pulse 72, temperature normal, abdominal fulness and local tenderness also gone, and the belly was now soft and flat. Only a little thickening could be felt in the place of the former tumour. No action of the bowels for two days. Tongue clean and wet, rather purplish; the appetite returned, and in the course of a few days she was able to leave her bed. The subsequent treatment consisted of an occasional small dose of castor oil and a simple enema.

Case 8. *Constipation, followed by fever and stercoraceous vomiting: perforation of the cæcum and stomach.*—Richard H—, æt. 43, well nourished, had been ill thirteen days before admission into the London Fever Hospital with constipation, anorexia, and latterly, continued fever. I first saw him on 12th April, 1870, on the fourteenth day of his illness; the pulse was 100, temp. 99·6°, tongue whitish and moist, the bowels open, and he was hungry. Very little change was experienced until the eighteenth day, when he had a slight rigor with loss of appetite. On the twenty-second and twenty-third days the bowels were loose, the motions pale and watery, and there was profuse perspiration, the skin being cool, and the pulse as yet had exceeded 116 on one day only, now it was 106. A little sordes still remained on the teeth.

On the twenty-fifth day, the abdomen became tense and tympanitic. There was no tenderness on making slight pressure, but he has suffered a good deal of pain in the epigastrium; tongue dry and wrinkled, the cutaneous veins of the abdomen large, the pulse 100.

On the twenty-sixth day the abdomen was less tense, and there were two abundant watery stools during the night, of the colour of burnt umber; the breath had a distinct pyæmic odour; the patient was apathetic and apparently comfortable. He continued in the same state, and on the twenty-ninth day he vomited for the first time about twelve ounces of brown bilious fluid. Next morning about an ounce and a half of grumous fluid, resembling pea-soup, was rejected. In the afternoon of this day the vomit had a distinctly stercoraceous odour, and consisted of pale, ochre-coloured, opaque matter, floating on and marbling a light yellowish-brown mucous

fluid. The bowels acted at intervals, the motions having the characters last described. The abdomen was smaller and softer, the veins less distinct, and free from pain and tenderness. The prostration, however, was increased.

On the thirty-first day he lay in a half-recumbent position, sunken, cold, clammy and apathetic with a strong post-mortem odour of the breath. He vomited frequently, rejecting in all as much as four quarts of bright gamboge-coloured matter of the consistence of thick gruel, and with a powerful fæcal odour; a similar fluid ran from the rectum every few minutes. The next day the symptoms were unchanged, save that the abdomen had become soft and doughy to the feel, with a central area of dull percussion; the previously thready radial pulse was now imperceptible, and he died tranquilly, retaining consciousness to the last.

After death.—The abdomen was retracted and dusky, the recti and other muscles of the abdominal wall almost black. The median incision below opened a sac corresponding to, and coextensive with, the pelvic cavity; it extended three inches upward from the symphysis pubis, and extended laterally from one iliac crest to the other; it was limited above by a straight wall formed by the coherent coils of the small intestine; below, by the bladder, which contained half a pint of urine; behind, by the sacrum and rectum; in front, by the abdominal wall. A strong membrane, apparently of not recent formation, was reflected from the edge of the adherent coils of the intestine to the peritoneal covering of the hypogastric region.

The sac was everywhere closed except where it communicated with the cæcum; its inner surface was covered with a granular villous growth of a light brown colour, stained, indeed, by the contents of the sac, its large cavity being full of bright yellow grumous fluid, a little thicker than that which had been vomited but otherwise exactly resembling it. The cæcum and ascending colon, which formed the boundary of the sac on the extreme right, presented four rounded perforations, the lowest at the bottom of the cæcum by the side of the vermiform appendix, the second just above, the third (which was the largest, and about three quarters of an inch wide) two inches higher up, and the fourth an inch and a half above this. These openings into the sac had thick,

almost villous lips, as if formed of everted mucous membrane The coils of intestine were flaccid, of a leaden hue, and adherent by organised membrane. The opening of the vermiform appendix was small and healthy, and the organ itself lay compressed against the walls of the fæcal sac. The colon, sigmoid flexure and rectum were quite healthy and empty; neither the jejenum nor the ileum showed any signs of ulceration, but were full of fluid like that in the sac. On dissecting out the adherent coils of the intestines numerous small isolated abscesses were discovered here and there.

A second fæcal sac, apparently quite distinct from the former, and only communicating with it through the bowel, lay deep in the right hypochondrium between the abdominal wall and matted coil of intestine, and limited above by the gall bladder and the under surface of the liver. The contents were identical with those of the largest sac. On opening the stomach the mucous membrane showed patches of slight congestion; in the posterior wall was a round aperture, with smooth edges, nearly large enough to admit the tip of the index finger; it communicated with an enlarging passage, which seemed to end in a *cul-de-sac* above the head of the pancreas, but which probably communicated with the sac of the small omentum, in which there was also a collection of fæculent fluid.

Excepting the stomach complication and its results, an almost identical case was admitted under my care very soon afterwards, and this was equally unsatisfactory in reference to the previous history. In neither case could I assign the date of perforation with any degree of certainty, but my impression was that it had occurred in both cases before admission. The perforation of the stomach in the case narrated here, appeared to have happened subsequently to those of the cæcum—on the 25th day? This was probably the cause of the vomiting, for the fæcal sac, into which the pelvic cavity was converted, formed a diverticulum to the cæcum, and communicated so freely with it that there did not seem the least liability to obstruction.

ON A CASE

OF

HYDATID DISEASE OF THE LIVER,

AND

REMARKS ON THE TREATMENT OF SIMILAR TUMOURS.

BY

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The following case of hydatid disease of the liver, in which cure has been effected, presents, from the enormous size of the tumour, its communication with the gall-bladder, and the occurrence of hæmorrhage from the liver, so many points of interest that I have thought it worthy of bringing before the notice of the Society.

In June, 1863, Mr. B. G—, æt. 29, a gentleman of good development and vigorous constitution, applied for my advice on account of a large tumour which had arisen in the epigastric region about four years previously, and slowly increased to such an extent as to cause, when dressed, very conspicuous deformity of the chest and abdomen.

At this time the patient was moderately muscular, defi-

cient of fat, pale and sallowish, with dark areolæ around the eyes. All the functions were naturally performed. He had been, and continued to be, constantly engaged in an office in the City. Long standing induced a feeling of faintness; but he was able to go about as usual, and not unfrequently walked four miles without inconvenience. The lower half of the chest and the whole of the abdomen were enormously but uniformly distended by a dull, tense, fluctuating tumour. The lower ribs, as well as those bounding the lower part of the chest-wall, were pushed widely outwards. The distance between the point of the ensiform cartilage and the umbilicus was much increased, and the most prominent part of the tumour corresponded to the centre of this elongated space. As the tumour ascended beyond the margin of the chest-wall in front, and at the sides where the parts were very much stretched, no limit could be felt in the upward direction. Below, the tumour gradually subsided towards the pubic region, and its lower rounded border could be distinctly felt two fingers' breadth above the pubis and the inner ends of Poupart's ligaments. From this lower boundary, and excepting a narrow space on either side of the abdomen, uninterrupted dulness extended upwards to all parts of a horizontal line surrounding the chest on a level with the nipples. Percussion upon either of the distended regions produced distinct fluctuation throughout the whole of the tumour. Neither the liver, the spleen, nor any other solid body could be felt. Two little veins emerged at the right edge of the ensiform cartilage, and formed swollen ramifications as they passed upwards and disappeared.

Over the most prominent part of the tumour—a point midway between the ensiform cartilage and the umbilicus—the body was 40½ inches in circumference.

Above the line of dulness, the lung-sounds were natural; but there was an absence of vesicular murmur, and distinct bronchophony was heard at the bases of both lungs behind. On taking a deep inspiration, a rubbing sound, like that caused by the motion of two pieces of wet leather the one

upon the other, was heard in the left scapular region. The heart was displaced upwards, and the cardiac dulness corresponded to a space of about two inches in diameter, the centre of which was half an inch above and to the sternal side of the left nipple. The heart-sounds were distinctly heard everywhere over the front of the chest on the left; they were most distinct a little above and to the left of the nipple, and thence towards the axilla. Over the natural position of the heart, and thence to the margin of the left ribs, the sounds were peculiarly naked and tense, as if transmitted from a distance by a good conducting medium. A moderately loud systolic bruit was heard at the base near the left edge of the sternum, on a level with the nipple; and, a little to the left of this, a fainter diastolic bruit. The pulse was natural, and the volume moderate.

Previous history.—The patient has lived temperately, is free from constitutional disease, and has always enjoyed good health; is liable to boils, but was never laid up with any illness except in connection with the disease under consideration; has never had rheumatism, nor any cardiac or pulmonary affection; never had jaundice or tapeworm; has lived seven years in Australia, and been exposed to the hardships incidental to a country life there; was often obliged to drink stagnant, and sometimes muddy water, and always preferred imperfectly cooked meat. He returned from Australia in the year 1859. In March of this year, and while still in Australia, he was attacked with severe stabbing pains in the left side of the abdomen, a little towards the front. For twenty-four hours the pain was continuous and agonising, and he could neither lie down nor suffer himself to be touched. The pain did not produce vomiting, but it was accompanied by a dry cough and sharp pain on inspiration. The pain recurred at intervals for a fortnight, and then gradually decreased. Since this time he has occasionally had a slight return of pain in this situation; and as pressure upon the left induces it, he constantly lies down upon the right side. About this time an abundant herpetic (?) eruption appeared upon the trunk and

limbs, and continued for some months. Some finely pitted scars, attesting its pustular nature, still remain upon the legs.

Three or four months after this severe attack of pain, in July 1859, while on his passage home, he discovered a little fulness of the epigastrium below the margin of the ribs; and since this time he has lost a little flesh, and his strength has gradually diminished.

In 1860 he had another attack of severe pain in the same part. He was laid up for a fortnight, and in the second week there was constipation for five days. Since this time the tumour has gradually increased to its present size. His health has continued fair, and his occupations have only been interrupted twice or thrice, and for only a day or two at a time, by the recurrence of the old pain and a feeling of weakness.

From the history of the case, and the nature and situation of the tumour, I concluded that the patient was the subject of hydatid tumour of the liver. As he enjoyed good health and his occupation required no great physical exertion, and as the tumour had already attained so great a size, I thought it better to recommend no present interference. I explained the nature of the disease to the patient, and directed him to avoid straining, jolting, and all violent motion, and to be slow and careful in all his movements. As his condition was somewhat anæmic I prescribed chalybeate medicine, and requested him to carefully notice if there should be any increase in the size of the tumour, and to see me from time to time.

October 8th, 1863.—Has enjoyed fair health and pursued his usual occupations continuously since June, and he is now in the same condition as at that date. Complains that he occasionally has deep-seated pain about the upper angle of the left scapula. It is sometimes very troublesome in bed. At times he experiences a deeply-seated pain in a single spot behind the left edge of the sternum, in the situation of the heart. Measurement around the body, at the same level as before (midway between ensiform cartilage and umbilicus),

shows an increase of half an inch, viz., 41 inches. The lower border of the tumour is rounded and distinct in the right iliac region; towards the left iliac region, a harder and more solid, thick, and slightly uneven boundary is felt. I take it to be the anterior margin of the left lobe of the liver.

July 7th, 1864.—Measurement over the same part 41¼ inches. No increased dulness of the chest, and the heart- and lung-sounds have not undergone any alteration. The patient complains of pain transmitted from below to a very tender little swelling over the junction of the manubrium and second piece of the sternum, whence it extends to the left shoulder and down the inside of the left arm.

In all other respects he has continued well, and there has been an increase in girth of only three fourths of an inch during the last year.

June 15th, 1865.—Measures around the same part 42⅝ inches. The tumour has descended a little, so as to leave another inch of horizontal resonance of the chest. The abdomen is fuller and the tumour more tense; otherwise the condition of the patient is the same as it has been during the last two or three years.

The tumour was at this time so tense, and the cyst-wall appeared so thin, that I now began to feel great anxiety lest it should be ruptured by some accidental strain. I cautioned the patient to avoid everything that might lead to such an issue, and determined to adopt at an early period some operative means for his relief.

July 17th, 1865.—On getting out of bed this morning, the patient was seized with a severe darting pain in the right iliac region; the pain increased at intervals to paroxysms of intense agony. The paroxysms were announced by a severe stabbing pain, which soon assumed an excruciating twisting and bursting character. While the pain continued the part was very tender to the touch; but in the intervals there was no particular tenderness, but only a fear lest palpation should excite the pain afresh.

I was summoned to him on the 21st of July, and saw him

in consultation with Dr. John Meaburn Bright, of Forest Hill, who was in attendance upon him. I found that the tumour had increased considerably in size in the right iliac region; but as yet there was no indication of the rupture of the sac, and the peritoneal inflammation was of very limited extent. Believing that a slight increase of fluid within the sac would determine its rupture and cause the death of the patient, I resolved to puncture the tumour. Dr. Bright concurred with me as to the necessity of this step, but we deferred the operation, hoping that the inflammatory action would result in adhesion of a portion of the sac to the abdominal wall, on account of which we might puncture the tumour with greater safety. For the present, therefore, we watched carefully and employed only palliative treatment.

July 26th.—The intervals of freedom from pain have been longer, and yesterday he was altogether free from pain for six hours. Since the 17th inst. the abdominal portion of the tumour has considerably increased in size. It is everywhere rounded; smooth, very tense, and everywhere fluctuant, and the fluid is evidently included within a single cyst. The pulse has lately risen to 120 during the paroxysm; and today there is superficial tenderness over the right hypochondriac and iliac regions, where the distension has lately increased very much. The patient is free from feverishness; the bowels have been well relieved by castor oil and enemata; opiates have given relief, but the patient has little or no continuous sleep.

The following are the measurements taken this day:—Round the body on a level with the tip of the ensiform cartilage, $40\frac{3}{8}$ inches; midway between the tip of the ensiform cartilage and the umbilicus, where the former measurements were made, $44\frac{1}{2}$ inches, which is nearly 2 inches more than the measurement taken only a month previously. Over the umbilicus, 40 inches; midway between the umbilicus and the pubes, $37\frac{3}{4}$ inches; from the tip of the ensiform cartilage to the pubes, $13\frac{1}{2}$ inches. As the tumour was undergoing such rapid enlargement, I resolved to delay no longer in evacuating the fluid. The patient willingly acceded. On further

consideration, I concluded that it would not be safe to tap in the right hypochondriac region, for I did not feel sure of the adhesion of the sac in this situation; I therefore selected a point in the median line midway between the ensiform cartilage and the umbilicus, where the tumour was most prominent. The patient kept the recumbent posture, and bandages having been previously applied around the margin of the ribs and the abdomen, Dr. Bright introduced a No. 11 canula, which on withdrawal of the trocar readily slipped backwards to its shoulder; the trocar having been introduced, with the point directed very slightly upwards, for the distance of only an inch.

Dr. Ray, of Dulwich, and Mr. Hill, of Sydenham, were present at the operation, and kindly gave us their assistance.

Immediately that the trocar was removed, fluid as limpid, clear, and colourless as water, was ejected with great force. The complete evacuation of the fluid occupied two hours. I occasionally interrupted the flow for a minute or two at a time, in order to secure the more effectual contraction of the cyst. The last two or three pints oozed slowly away, and the discharge was facilitated by pressure on the abdomen and sides of the chest, and ultimately by causing the patient to take deep inspirations. Nineteen pints and a half (390 ounces) were ultimately withdrawn. The greater portion of the fluid was colourless; but towards the end of the operation it gradually assumed a light yellowish colour, which increased in intensity. The last pint was grumous and of a bright yellow colour from admixture with bile. Not a trace of blood appeared throughout. Some ruptured hydatid cysts of gelatinous appearance, about the size of walnuts, and a number of minute unruptured ones, the size of peas, came away with the fluid. The evacuation of the fluid was unattended by pain, and gave the patient immediate relief. There was no tendency to syncope; the abdomen became quite flaccid and free from pain on pressure, and the rounded outline of the shrunken cyst could be felt distinctly just below the umbilicus, and thence extending upwards on the sides

towards either hypochondrium, where the outlines were indistinct. At the end of the operation, a little fluid continued to run from the canula on taking a deep inspiration; and as I had determined not to remove the canula so long as there should be any oozing of fluid, a pad of lint and a folded towel were placed over the orifice, and the whole retained by moderate pressure with the abdominal bandage.

Flannel rollers were tightly applied around the lower margin of the chest. The pulse after the operation was 95, soft and compressible. To take 10 grains of compound soap-pill to-night.

The morning after the operation, the patient was in a very comfortable condition. He had passed a good night, and was now free from pain. The abdomen soft, flaccid, and free from tenderness. Pulse 124; respirations 30. A severe eruption of urticaria covers the neck and arms. The bandages and compresses are saturated with discharge, and stained bright yellow. The canula was worn without inconvenience, and a yellow bilious fluid containing a little mucus constantly oozed from its orifice.

Three days after the operation, a large rounded tumour about the size of a child's head could be felt in the right hypochondriac and epigastric regions. In common with the rest of the abdomen, these parts were free from tenderness.

The patient continued free from febrile disturbance and pain, and progressed most favorably, living upon a liberal allowance of mixed animal and vegetable diet and stimulants, until the *eighth* day, when, the canula having partially slipped out of the wound, there was complete retention of the discharge for about twelve hours. The distended sac was tender, and formed a rounded prominence in either hypochondrium; there was pain along the margin of the left ribs; the skin was hot; the countenance very sallow. Pulse 120; respirations 17. On replacing the canula, eight ounces of deep yellow turbid fluid of offensive odour were immediately evacuated, and free discharge of the contents of the sac was re-established. The febrile symptoms disappeared, and all went on well until the membranous walls

of disintegrated hydatid cysts began to obstruct the discharge. Fragments of laminated membranes first appeared on the *tenth* day; but they did not cause any obstruction until the *fifteenth* day, when there was complete arrest of the discharge. The sac was distended, and the pain along the margin of the left ribs and febrile action were renewed. An elastic catheter was introduced through the canula to a distance of nine inches within the sac, and with some difficulty twenty ounces of light ochre-coloured, slightly viscid fluid, and much broken-down cyst-wall, were evacuated. This was followed by immediate relief.

For the first fifteen days, about twenty ounces of fluid were discharged every twenty-four hours, but on several occasions it was much more abundant; and this temporary increase was apparently due to rupture of the larger secondary cysts.

From the *fifteenth* to the *seventy-eighth* day, disintegrated cyst-wall was constantly discharged, causing impediment, and occasionally, for a few hours at a time, complete obstruction to the discharge of the fluid contents of the sac. During the whole of this period great difficulty was experienced in emptying the sac.

On the *forty-third* day, the canula was removed, and a No. 9 elastic catheter inserted and retained in place of it. From this date to the *fiftieth* day the discharge diminished to four or six ounces daily, and the sac meanwhile became distended. On the last-mentioned day, twenty ounces of fœtid fluid were withdrawn, and the discomfort and feverishness attendant upon the distension of the sac abated.

The day after, a new and dangerous symptom appeared. Hæmorrhage to a considerable extent took place within the sac. The pulse went up from 96 to 140, and in the evening to 160. Vomiting had occurred several times; the skin was hot, dry, and jaundiced; the epigastric and hypochondriac regions were occupied by the hard and distended sac, but the rest of the abdomen was soft and natural. A pint of thick, fœtid, bloody fluid, of the same rich chocolate-red colour as the blood which exudes from the cut surface of

fresh liver, was removed from the sac. Fragments of cyst-wall continually obstructed the eye of the catheter, so that very little discharge now oozed from its outer extremity. By patiently withdrawing and introducing the catheter time after time, and injecting creasote water through it to wash away the débris of the cysts, half a pint more of the bloody fluid was removed.

For many days the fæces had been completely destitute of bile, and were of a glistening aspect and putty colour. This evening the patient passed a very copious pultaceous shiny stool, having the same rich reddish-brown colour as the discharge from the sac. It was clear that the distended sac had relieved itself by the passage of a portion of its contents into the intestinal canal.

During the next week, much disintegrated blood-clot came away, and oozing of blood within the sac continued. The patient meanwhile was much weakened and depressed. The jaundice disappeared, and the appetite had returned on the *fifty-third* day. The alvine secretions, however, continued to be entirely destitute of bile, and they were very offensive. The discharge from the sac had contained a large quantity of bile from the first, and the proportion of this secretion appeared now to be on the increase. After the sac had been washed out, a stream of pure, unmixed ropy bile flowed from the orifice of the catheter as it lay inserted eight or nine inches within the sac. I collected half an ounce of this pure bile in the course of a few minutes, on several occasions. It was evident that we were in direct communication with the gall-bladder, and that the discharge from the sac, which some days previously had found its way into the intestine, must have been conveyed by the bile-duct. The discharge of pure bile at the end of dressing continued from the *fifty-seventh* to the *sixty-fifth* day. The discharge from the sac then resumed its usual bilious character, and decreased in quantity The fragments of the cysts continued to offer a great obstruction to the flow of the discharge, although the passage leading to the sac was now sufficiently dilated to admit three large elastic

catheters. But on the *seventy-fifth* day we succeeded in evacuating a teaspoonful of thick laminated membranes, some of which were six inches square. This was effected by moderately distending the sac with creasote water, and suddenly withdrawing the three catheters, the patient giving at the same time a series of little coughs. Excepting a stray fragment or two, the whole of the laminated membranes that had been retained in the sac were removed on this occasion, and henceforward there was no impediment to the flow of the discharge, nor difficulty in washing out the sac. On two occasions, the sixty-second and the seventy-fifth days, large thick fragments of dense blood-stained fibrous tissue came away. These were, no doubt, portions of the original cyst which had become detached from the liver. The hæmorrhage was clearly due to the separation of these fragments, and the exposure of the parenchymatous substance of a portion of the liver.

On the *eightieth* day, the patient had recovered his lost ground, and the fæces had returned to a natural condition.

On the *eighty-first,* a severe attack of dyspepsia, accompanied by great flatulent distension of the abdomen, and violent eructations and vomitings, occurred. The attack lasted with decreasing severity for a week; meanwhile the discharge from the sac increased. Of late the average had been eight ounces in the twenty-four hours, and it was a dirty yellowish-white muco-purulent fluid; but at this day, and for the following week, from sixteen to twenty ounces of a grass-green mucous fluid—diluted bile—were daily discharged; and this was associated with absence of bile from the alimentary canal. The sac, however, was daily contracting, and I began to fear that the common bile-duct would be so implicated in the contraction as to become obliterated. It was with extreme satisfaction that Dr. Bright and myself witnessed the reappearance of bile in the stools on the *one hundred and second* day.

During the next month, the bilious discharge gradually decreased.

On the *one hundred and twenty-third* day, the discharge was totally free from bile, and consisted of dirty-white inodorous pus, amounting to three ounces only in the twenty-four hours. The sac meanwhile contracted, and the catheter, which formerly passed nine or ten inches into its interior, would now pass only four inches.

On the *one hundred and thirty-eighth* day, a tinge of bile appeared for the last time. The sac had almost entirely contracted. The discharge consisted of a dirty-white inodorous pus, and did not exceed a table-spoonful in the twenty-four hours: the catheter merely occupied the retracting passage, and not more than two drachms of fluid could be injected.

On the *one hundred and forty-eighth* day, the discharge had ceased, and the catheter was finally removed. During the last month the patient had rapidly regained flesh and strength, and he was able to leave his room and walk out.

On the *one hundred and fifty-eighth* day (January 1st, 1866), the patient resumed his ordinary occupations in the City, and has continued them without interruption up to the present time, with the enjoyment of increasing health and strength.

The following was his condition on the 1st of January, 1866, rather more than five months after the puncture of the tumour:—A little stouter than he was before the operation, but pale and anæmic. Measurement around the body at the level above indicated—viz., midway between the ensiform cartilage and the umbilicus—31½ inches, being 13 inches less than the measurement on the day when the tumour was punctured, and 9 inches less than when the patient first came under my notice, in June, 1863. The cicatrix retracted upwards, and the parts around dull and hard. No trace of the tumour remains. The hepatic dulness normal. The spleen feels hard, and it is enlarged, projecting below the margin of the left ribs. The appetite is good; the bowels act regularly, and the fæces are quite healthy. The compressed lungs have expanded, and

the extent of resonance and vesicular breathing is normal. The heart has returned to its proper position; the first sound is now healthy, and the second is accompanied by only a faint diastolic bruit.

I made my last examination of my former patient on the 7th September, 1866, when these sheets were in the printer's hands. The following are the particulars:—Body fat and muscular, and complexion healthy; weighed before the operation from eleven stone to eleven stone three pounds; weighs now eleven stone, showing an increase, *minus* the tumour, of about two stone; figure perfectly natural. The cicatrix looks exactly like a second navel, situated midway between the tip of the ensiform cartilage and the umbilicus. The hypochondriac regions and the epigastrium, including the parts immediately around the cicatrix, are perfectly soft, and the fingers deeply pressed into these regions fail to detect any tumour or thickening whatever, or to excite pain or uneasiness. The epigastric and left hypochondriac regions are resonant. The liver dulness is of normal extent, commencing four fingers' breadth below the right nipple and terminating at the margin of the ribs. The abdomen is flat and natural, and the spleen has returned to its normal size and position—indeed it can no longer be distinguished. Measurements:—From the tip of ensiform cartilage to the umbilicus, $5\frac{1}{4}$ inches (the cicatrix is equidistant from these parts, inclining a little to the left of the median line, and is slightly retracted upwards); around the body, on a level with the cicatrix, $33\frac{1}{2}$ inches; and on a level with the ensiform cartilage, 34 inches. Resonance of the chest of normal extent; lung-sounds healthy. Cardiac dulness normal in extent and situation, apex-beat an inch below, and internal to the left nipple. The systolic bruit is no longer heard, the first sound being strong and healthy; a distinct sawing sound accompanies the diastole. Its seat is immediately beneath the junction of the first and second bones of the sternum. The pulse is natural; all the functions are healthily performed. Although his work has been unusually heavy since he resumed it

in January, he has progressively improved in health and strength.

Treatment.—As there was no evidence of the adhesion of the walls of the cyst to the abdominal parietes, I feared to do less than withdraw at once the chief bulk of the fluid; and when I found that the elasticity of the sac was such as to expel the fluid with extreme force, I had reason to be satisfied that I had not adopted partial measures, such as capillary tapping or the removal of only a portion of the fluid. In this case either of these modes of treatment would most probably have been followed by the escape of hydatid fluid into the peritoneal cavity. Anticipating that the sac would rapidly refill—in which case the introduction of the trocar and withdrawal of the canula would have been almost equivalent to rupturing the sac and allowing its contents to escape into the abdomen—I resolved to retain the canula within the wound as long as there should be any discharge.

Dr. Bright used a medium-sized instrument, and the treatment consisted in placing a flannel bandage around the abdomen, below the canula, with a compress upon the right hypochondrium, and another bandage around the lower part of the chest above the canula, which latter was retained in its position by placing folded diapers over its orifice and retaining them by another light bandage. The canula was retained within the wound until the 7th September, when having become loose and inclined to slip out of the wound, it was removed, and an elastic catheter (No. 9) introduced into the sac in its stead. Prior to this, the discharge of the cyst-wall of the disintegrated hydatids began to obstruct the discharge of the fluid which constantly accumulated within the sac. Fearing that an elastic catheter would not be effectual in maintaining a direct passage into the sac, and that there might be some difficulty in reintroducing it, I wished to preserve the communication with the sac by means of a curved silver tube. A No. 12 double-canuled silver catheter was readily introduced nine inches within the sac, but it proved useless. I therefore procured a

silver tube, curved like an ordinary catheter, of No. 16 gauge, a little contracted at the point to facilitate its introduction, and terminating in a round orifice of No. 11 gauge. This tube passed without much difficulty into the sac, and it was worn with comfort for three days but not an ounce of discharge flowed away through it during the whole of this time, and the accumulated discharge was evacuated by other means at the times of dressing. On visiting the patient on the evening of September 22nd, we found that no fluid had been discharged through the silver tube, although the sac was distended, and the wide tube moved freely in every direction in the accumulated fluid. It was removed; the discharge was evacuated with difficulty by means of an elastic catheter. The silver tube was again introduced, and about a pint of creasote water injected; none returned until the sac was painfully distended, when about half a pint was rejected with a sudden gush; more could not be obtained, although the tube was moved to every part of the sac, and inserted now a short way, and now seven or eight inches within it. It was evident that the orifice of the tube was entangled amongst the detached laminæ of the hydatid cysts, which being forced towards it in every direction by the distension of the sac, occluded it like so many valves. The same thing occurred when a single catheter was introduced, and we now began to experience the greatest difficulty in evacuating the contents of the sac. The mode in which it was effected for two or three weeks about this time was as follows:—A No. 9 elastic catheter was inserted into the sac; a little discharge would then flow for a second or two, and then an arrest occurred; a fragment of cyst-wall was removed from the orifice of the catheter, or a little creasote water injected to wash it out of the internal orifice, and the discharge would perhaps again flow. By this means, and by frequently removing the catheter and washing cyst-wall out of its eye, and by teasing away fragments which had followed it to the orifice of the wound, the sac was emptied and washed out with cold creasote water (℞ Kreasoti ℥xl, Aquæ ℨxxxvj) every night

and morning. Dr. Bright attended the patient night and morning throughout the progress of the case, and to his assiduous and patient attentions the safety of the patient was due. The time required to evacuate the contents of the sac and the difficulty in effecting it, now required the adoption of some means to effect the dilatation of the passage for the discharge of the larger coriaceous fragments of cyst-wall. For this purpose I employed elastic catheters: we left three small ones (Nos. 9, 7, and 4) in the sac, and by daily increasing their size to No. 12 our end was attained. When the catheters were introduced within the sac so that their extremities reached to slightly unequal distances, the cyst-wall was generally kept away from the orifice of one at least, and while creasote water was being injected along one catheter, discharge accompanied by cyst-wall was ejected from the others. By this means thickish laminated fragments six square inches in extent were discharged. On October 11th, the passage was sufficiently dilated to allow of the discharge of a teacupful of large leathery fragments of cyst-wall—all, in fact, that now remained within the sac. The ejection of these was secured by injecting the sac with creasote water and preventing its escape, and then suddenly withdrawing the catheters while the patient gave a succession of coughs.

While we were endeavouring to secure free discharge of the fluid formed within the sac, I had two other objects in view: viz., 1st, to prevent decomposition of the contents of the sac; and, 2nd, to excite inflammatory action within its interior. These were attained by the injection of iodine and creasote water: ʒj of the compound tincture of iodine of the London Pharmacopœia was injected into the cyst three days after it was tapped (July 28th); and this was repeated morning and evening for about a week, when the quantity was increased to ʒij twice a day. From the 14th to the 23rd of August, ʒj of the tincture was injected through the canula daily. The evening injection was now discontinued on account of the profuse night-sweats which it appeared to produce, and ʒvj were injected every morning only, until the

17th of September, when the injection of iodine was left off altogether. During these seven weeks, upwards of ℥xxx of the tincture of iodine, diluted with an equal quantity of creasote water, were thrown into the sac. No pain was ever produced; but when the sac became a little tender, a feeling of warmth in the epigastrium followed the injection.

The iodine injection was continued until hæmorrhage occurred within the sac, when gr. v—gr. x of nitrate of silver, dissolved in a few ounces of water, was substituted, the sac being previously washed out as before with creasote water. At the end of a week I discontinued the nitrate of silver, and directed the sac to be first washed out with plain creasote water, and, subsequently, with ʒj of sulphate of zinc dissolved in ℥x of creasote water, every morning and evening.

Throughout the whole treatment I found it of the utmost importance to give support to the lower part of the chest, and had laced bandages made for this purpose. The ribs had been so widely distended, that if left to themselves they were laxly divergent. It was equally necessary to keep the abdomen tightly bandaged, with a compress upon the right side so as to press the contracting sac towards the right hypochondrium. As often as the compress was set aside, a slight distension took place in that most dependent part of the sac which lay in the right iliac region. Another difficulty that we had to contend with was the deficiency, and, for a very considerable portion of the time, a total absence of bile from the intestines. Fortunately, the patient's appetite did not suffer in consequence, and I attempted to supply the place of the absent secretion by the introduction of inspissated ox bile, in doses of 20 grains, every night, with occasional intervals. For the greater part of the time he took ♏xv—xx of perchloride or pernitrate of iron, alone or in combination with quinine.

At one period (Oct. 16—20) the patient was greatly troubled with flatulent dyspepsia, and this was associated with fæcal accumulation in the ascending colon, and it was necessary to employ free purging. The accumulation was,

doubtless, to be attributed to adhesions, which, having formed between the sac and the right bend of the colon, impaired the contraction of this part of the alimentary canal. Pressure upon the right hypochondrium at these times readily induced eructations.

General observations and rules for treatment.—It is remarkable how little disturbance of the sympathetic system occurred throughout the treatment of the case, and how readily the displaced and compressed viscera resumed their position and recovered from the effects of pressure so prolonged. The tumour was seated in the midst of the sympathetic plexuses, and caused distension of all parts about the solar plexus. The sac evidently lay upon the aorta, for whenever a catheter was passed backwards until its point touched the posterior wall of the sac, strong pulsations were felt; at one time it was easy to feel that the sac had contracted extensive adhesions with the diaphragm along the margin of the ribs upon the left side, and whenever it became distended pain was felt in this region. The absence of bile from the intestinal canal was always associated with a disgust for fat of all kinds; and the putty-coloured fæces contained undigested, unemulsified oil, which gave to them a soft glistening appearance, like that of frosted silver.

It would appear that the cyst was in an actively growing state; no cretaceous matter was ever observed in the discharges. The first ten or twelve pints of fluid withdrawn were of the usual character—a clear limpid, slightly salty fluid, destitute of albumen, and of specific gravity 1007. The last portions were turbid, from the presence of yellow grumous matter, altered and inspissated bile. Each drop of the turbid deposit contained multitudes of hooklets, free scolices, and minute cysts, the $\frac{1}{20}$th of an inch in diameter, containing numbers of attached scolices in all stages of development. The parasite was evidently derived from Australia, but the scolex is identical in appearance with that found in hydatid cysts of European origin.

The pure bile which was occasionally discharged un-

doubtedly came from the gall-bladder, for it contained so much mucus and was so viscid that it could be drawn out into strings more than a foot long. It was equally clear that the great cyst did not directly communicate with the gall-bladder, else the whole of the fluid would have been tinged with bile. I can only explain the fact by supposing that a small and probably collapsed hydatid cyst existed beside the large one, and communicated, on the one hand, with the gall-bladder, and, on the other, with the larger cyst, and that during the growth of the tumour the aperture of communication was closed either by the secondary cysts or by the compressed fluid in some such way as the orifices of the ureters are closed by a distended bladder.

Having observed this complicated case with much interest, and given it close attention, and subsequently studied the histories of those cases in which cure by operative measures has been attempted, I am convinced of the necessity of observing the following rules in the treatment of hydatid tumours of the liver :

1. They should be punctured *above* the umbilicus, because the sac, however large, possesses great elasticity, and ultimately contracts into the epigastric or hypochondriac regions.

2. As soon as operative measures are determined upon, the sac should at once be punctured with a large trocar, and the canula retained so as to keep up free communication with the interior of the sac. No care need be taken to prevent the admission of air ; there is much less danger in exposing the interior of a large cyst to the air for months than in closing up the external orifice for a few days. Nor ought we to be content with merely keeping a canula inserted ; but by passing a small catheter from time to time within it, should anticipate obstruction of the discharge and distension of the sac by pushing away, breaking down, or teazing-out the secondary cysts or their fragments, which, so long as they remain within the sac, will continue to impede or prevent the flow of fluid, however large the orifice of the canula may be.

3. The canula may be retained until it is loosened by suppuration and tends to slip out. Its place should then be supplied by two or three elastic catheters, and their size gradually increased until three or more of No. 12 size can be readily introduced. By advancing the ends of two beyond the others, and causing the eyes to look inwards towards each other, we have an effectual contrivance for preventing the closure of some, at least, of the eyes by the pliable fragments of cyst-wall. A single catheter, or a single wide tube, is ineffectual in emptying the sac.

4. In order to facilitate the disintegration of the cyst-wall, and to excite inflammation and adhesion of the sac, iodine should be freely injected. As soon as a glow of heat is felt on injecting it within the sac, or this becomes tender under pressure, the iodine injection should be discontinued.

5. To prevent decomposition of the fluid within the sac, it should be washed out morning and evening with creasote water (creasote 40 drops, water 36 ounces). I found this most effectual in preserving a healthy condition of the sac. On one occasion more than a gallon of cold creasote water was passed through the sac. The injection should be passed down one catheter, and allowed to flow out with equal rapidity through one or two others. Distension of the sac should be most carefully avoided, especially when it is healing. Pain, and, on more than one occasion, bleeding, was produced in the case above related by injecting the fluid faster than it flowed away.

6. After the separation and discharge of the cyst-wall, the sac may be washed out with a solution of sulphate of zinc in creasote water. I employed it in this case chiefly with the view of arresting and preventing hæmorrhage, but there can be no doubt that it facilitated the contraction of the sac, and I should be inclined to recommend its use in all cases during the healing of the sac.

7. For treating tumours of great size, the strictest attention must be given to bandaging, in order to preserve the contraction of the sac. In the case above recorded the

sac had evidently contracted such firm adhesions to the diaphragm and inferior margin of the chest-wall that, being firmly retained in the epigastric and hypochondriac regions, it extended itself chiefly in the lateral directions, pushing the inferior parts of the chest and lower ribs much outwards. Long after the softer parts had regained their resiliency I found that the bony chest-wall remained flaccid and spread outwards, and that by compressing the hepatic and splenic regions together the capacity of the sac was diminished, as evidenced by the escape of air or fluid. A laced bandage should be placed around the lower part of the chest, embracing the hepatic, splenic, and epigastric regions, before the sac is punctured, and it should be constantly worn and tightened during the contraction of the sac, and for some months after the patient has recovered. Support should equally be given to the abdomen, and compresses placed upon any depending portion of the sac. By these means the attenuated diaphragm is restrained in its movements until it has recovered.

8. Bleeding and the discharge of bile into the sac can only be effectually prevented by promoting its contraction. The external bandages should be tightened, and injections of nitrate of silver and sulphate of zinc freely used. If there be no impediment to the discharge from the sac, it may be frequently washed out with cold water.

As far as my search has extended I find that the tumour in the above case is the largest for which operative proceedings have been undertaken with success; and since the treatment here advocated has been successful in the case of so large a tumour, it may, *à fortiori*, be employed for the destruction of those of smaller size. The withdrawal of a pint or two of fluid from smaller tumours has not unseldom proved fatal, and we cannot be sure that such treatment will result in the radical cure of the disease (see Table I).

Appended are synoptical tables of all those cases of hydatid tumours of the liver in which operative measures have been adopted that I have been able to glean from

various sources. In my remarks I have endeavoured to point out the advantages of securing the free discharge of the contents of the sac, and the dangers which follow its suppression. In the compilation of these tables I am chiefly indebted to four sources :

1. Mr. Cæsar Hawkins's papers "On Eycysted Tumours of the Liver" in the 18th vol. of the 'Medico-Chirurgical Transactions;'

2. M. Cruveilhier's Art. "Acéphalocystes," in vol. i, 'Dictionnaire de Médecine et de Chirurgie pratiques;'

3. M. C. Davaine's 'Traité des Entozoaires;'

4. Dr. Cobbold's 'Entozoa.'

From an analysis of these 100 cases it appears—1st, that of the 34 cases which were treated by a single puncture, evacuation of a portion or of the whole of the fluid, and immediate closure of the wound (see Table I), there were 11 *cures*, 13 *recoveries*—*i. e.* cases which were relieved by the operation, but which, since the tumour was not wholly removed or the result sufficiently certified, cannot be regarded as radical cures—and 10 *deaths*. Irritating injections were employed in Cases 27, 31, 33, and 34. One death (Case 13) was probably due to premature labour two or three weeks after the operation, the cyst being found collapsed; another (Case 15) was caused by rupture of another cyst into the lungs.

In the great majority of cases a single puncture is wholly ineffectual (see Tables II, III, IV, and V), and those who most strongly advocate this mode of treatment admit that it is only effectual where the tumour is of small capacity. Unless decided inflammatory action ensue within the cyst, which in a closed sac must always be attended with great danger, destruction of the parasite and radical cure of the disease can hardly be expected. In Cases 96 and 99 the parasite continued to maintain its existence for many years, notwithstanding the spontaneous rupture of the cyst and (in one) the operation performed upon it three years afterwards. The immediate dangers of puncture and closure of the wound are due—1st, to re-accumulation of fluid and

distension of the sac, resulting, when there are no adhesions with the abdominal wall, in overflow into the peritoneal cavity or elsewhere (*e. g.* Cases 32, 35, &c.); and 2nd, to excessive inflammatory action and the formation of putrid fluid within the sac. In Cases 48, 51, 54, 63, &c., clear watery fluid followed the first puncture, and fœtid pus the second. This second danger might probably be avoided by the plan adopted by Dr. Budd (see Case 1). In five, at least, of the fatal cases (Table I) death is attributable to re-accumulation of the fluid and its alteration and retention within the sac. In several cases of recovery re-accumulation of fluid took place, and in some this was accompanied by considerable pyrexia. But even when the death of the parasite follows capillary puncture, a simple cyst may remain, or the sac and its contents may undergo steatomatous or calcareous degeneration—results which cannot be considered as altogether satisfactory, when it may be proved that radical cure —*i. e.* the complete evacuation of the contents of the cyst, and the contraction and healing together of its walls—can be effected with less risk of a fatal termination. Case 56 shows how safely the means for the radical cure of the disease advocated in this paper may be employed against a small tumour.

Of 13 cases treated by successive puncture, with or without the injection of iodine (see Table II), there were 8 recoveries, 3 deaths, and 2 cases in which the operation was ineffectual. In two of the cases of recovery iodine injection was employed. In one case (47) ten punctures were required, and the last one followed by a strong iodine injection, and still the cure was incomplete. In two cases (35 and 38) five tappings proved ineffectual, and death was doubtless due to the retention of the accumulated fluid, thus showing the necessity of maintaining a free communication externally.

Of the 30 cases in which the tumour was punctured once or oftener, and an external communication sooner or later preserved (see Table III), there were 23 cures, 18 at least of which may fairly be considered as radical, and

7 deaths, a proportion, notwithstanding the larger size of the tumours, less than that which followed simple puncture. The fatal result in five of these cases is directly attributable to re-accumulation of the discharge or to its retention and decomposition within the sac. The necessity for preserving an opening for the free discharge of fluid from the sac is well illustrated by Case 63.

Of 13 cases in which the tumour was directly incised (see Table IV), there were 6 cures and 7 deaths, a much larger proportion than resulted when the other modes of treatment were adopted; but it will be observed that some of these cases were taken for ordinary abscess, and no means employed to secure the flow of discharge from the sac. Even when a free incision has been made the discharge may most effectually be obstructed by one or more secondary cysts, floated against the outlet. Case 80 shows the advantage of making and maintaining a free opening.

Of 10 cases in which the tumour was opened by caustic potash, or by spontaneous absorption and rupture of the integuments and cyst-wall, there were 3 cures, 3 recoveries, in which the disease continued, and 4 deaths.

Attentive consideration of all the cases in which the tumour has been opened, whether by trocar, by the knife, or by caustic, will still further assure us, on the one hand, that the chances of recovery are in exact proportion to the care taken in the evacuation of the contents of the sac; and, on the other, that the fatal result is due, not to exhausting discharges from a large suppurating cavity, but to a want of care in evacuating the cyst membranes, and thus securing the discharge of fluid which, sooner or later, becomes putrid and poisons the blood. In only one of these 100 cases did the patient die from the exhaustion induced by prolonged discharge from the sac, and in this case the great cyst in the liver was found "full of hydatids and a purulent fluid." (See Case 82.) The advantages of a free opening and the speedy evacuation of the contents of the sac are well seen in Case 56.

In the treatment of hydatid tumours of the liver there

are two other points which deserve consideration, viz., the use of caustic potash and the injection of bile. Careful review of the cases in which the former has been employed, for the purpose of causing adhesion between the sac and the abdominal wall, or with the further object of opening the tumour, will serve to show that it is ineffectual for the first of these purposes (see Case 73), and that it possesses no advantage in effecting the second. Such painful treatment, therefore, may very well be altogether laid aside. As to the injection of bile into the sac, in order to cause inflammatory action within its interior and destruction of the entozoon, it is only necessary to observe that the cyst is so frequently found in direct communication either with one of the branches of the bile-ducts or with the gall-bladder itself as to lead one to the conclusion that the animal enters the liver by the common bile-duct, and that the hydatid tumour is sometimes, at least, formed as a diverticular growth from the walls of some one of its branches within the liver, or, perhaps, within the obstructed portion of the duct itself. In Vol. XVIII, p. 148, of these 'Transactions,' a case is recorded in which the common bile-duct was obstructed near its duodenal end by a hydatid cyst. Dr. Billing records a case ('Med. Gaz.,' vol. vii, p. 542) in which hydatids were found free in the gall-bladder. Jaundice and death has ensued from plugging of the common bile-duct by hydatids. (Dr. Nicholson, 'Med. Times and Gaz.,' 1861, vol. ii, p. 515.) See also Dr. Barlow's case, 'Guy's Hosp. Reports,' vol. vi, ser. 2, p. 185; a case by Dr. Bristowe, 'Path. Soc. Trans.,' 1858; and Case 4, Table I, of this paper.

SYNOPTICAL TABLES OF THOSE CASES OF HYDATID TUMOUR OF THE LIVER IN WHICH CURE WAS ATTEMPTED BY OPERATIVE PROCEEDINGS, INCLUDING THOSE IN WHICH SPONTANEOUS RUPTURE TOOK PLACE EXTERNALLY.

TABLE I.—*Cases in which the cyst was opened by a single puncture, the canula withdrawn, and the opening allowed to close by primary adhesion or otherwise.*

No.	Sex and age.	Situation of the tumour and treatment.	Nature and quantity of fluid withdrawn at the operation.	Progress.	Result and remarks.	Reference to author.
1	M. adult	Large tumour of liver. Tapped with ordinary sized trocar, and fluid withdrawn by a double acting stomach-pump syringe, fitted to the canula so as to prevent the entrance of air into the sac	7½ pints of hydatid fluid	Immediate relief. Liver still large from presence of hydatid sac, which, although emptied of its contents, was still of considerable size. No increase of girth two months after, and recovery of flesh and strength	Tumour reduced in size Recovery	G. Budd, M.D., 'Med. Times and Gazette,' 1860, p. 494.
2	M. 56	Large fluctuating tumour occupying the right hypochondriac, the epigastric, and part of the left hypochondriac regions. Tapped with medium-sized trocar, and issue of—	5 pints of thick tapioca-like fluid and broken down hydatids	When seen a fortnight after, there was no reaccumulation, and the patient was apparently quite well	The patient did not remain long enough under treatment to assure us of its ultimate results Recovery	Mr. Holthouse, 'Med. Times and Gazette,' 1860, p. 344.

3	F. 30	Large tumour occupying the right hypochondrium. Puncture with small trocar. The cyst appeared only half emptied when the fluid ceased to run	1 to 2 pints	Inflammation of cyst with presence of air, then slow diminution of tumour, which could not be detected eight months after the operation	Radical cure	Mr. Jonathan Hutchinson, 'Lancet,' 1862, vol. ii, p. 389.
4	F. 15	The whole abdomen distended with a fluctuating tumour. Paracentesis abdominis, and evacuation of—	12¼ pints of brownish and intensely bilious fluid	Temporary relief; reaccumulation of fluid, and death on the 23rd day. The cyst was found to be in communication with the gall-bladder	Death	Dr. Headlam Greenhow, 'Lancet,' 1862, vol. ii, p. 476; Dr. Murchison, 'Ed. Med. Journ.,' 1865, case xiv, p. 513.
5	M. 12	Fluctuating tumour in the right hypochondrium. Tapped with a flat trocar	1½ pint of colourless hydatid fluid	No constitutional symptoms. Recovered and left the hospital in a short time	Recovery	Sir B. Brodie; Mr. Cæsar Hawkins, 'Med.-Chir. Trans.,' vol. xviii, p. 118; Davaine, 'Traité des Entozoaires,' obs. cclviii, p. 569; Budd, G., 'Disease of Liver,' 3rd ed., p. 460.
6	F. 20	Fluctuating tumour of the abdomen connected with the liver. Tapped with medium-sized trocar	3 pints of clear fluid	No bad symptoms. The patient was seen after six years, and there was no return	Radical cure	Sir B. Brodie; Mr. Cæsar Hawkins, 'Med.-Chir. Trans.,' vol. xviii, p. 119; 'Med. Gaz.,' vol. i, p. 334; Davaine, obs. cclix, p. 569; Budd, 'Dis. of Liver,' 3rd ed., p. 460.

No.	Sex and age.	Situation of the tumour and treatment.	Nature and quantity of fluid withdrawn at the operation.	Progress.	Result and remarks.	Reference to author.
7	M. 14	Tense elastic tumour of the right hypochondrium. Tapped with a medium-sized trocar—	Upwards of 3 pints of clear fluid	"The wound healed, and the disease probably did not return"	Recovery	Dr. Thompson; Mr. Cæsar Hawkins, 'Med.-Chir. Trans.,' vol. xviii, p. 121; 'Med. Gaz.,' vol. i, p. 468.
8	F. adult	Tumour of liver. Tapping with medium-sized trocar, and removal of—	16 pints of watery fluid	"The result is not mentioned, so that it may probably be concluded that the case ended fatally"	Death (?)	Mr. Cæsar Hawkins, 'Med.-Chir. Trans.' vol. xviii, p. 121.
9	—	Tapping of the anterior of two distinct cysts in liver, and withdrawal of about—	8 pints of watery fluid	Death a few days afterwards. Another cyst containing about 12 pints of clear fluid was found between the liver and diaphragm	Death	Abercrombie, 'Dis. of Stom.,' p. 356; Mr. Cæsar Hawkins, in 'Med.-Chir. Trans.,' vol. xviii, p. 123.
10	F. adult	Fluctuating tumour of the liver. Puncture with common trocar, and removal of—	A washhand-basinful of broken-down hydatids and thick yellowish fluid	Temporary relief, and death shortly afterwards	Death	Dr. Hewett; Mr. Cæsar Hawkins, 'Med.-Chir. Trans.,' vol. xviii, p. 157.
11	Boy	Hydatid tumour of the liver. Tapped with common trocar, and—	12 pints of greenish water evacuated	Death two days after. Gall-bladder contained 8 pounds of bile, the duct was full of gall-stones. A large hydatid cyst of the spleen also existed	Death	'Edin. Essays and Obvs.,' vol. ii, p. 352; 'Med.-Chir. Trans.,' vol. xviii, p. 152.

12	F. adult	A small tumour of right hypochondrium. Punctured with a very fine trocar, and evacuation of—	A small quantity of limpid, salty, non-albuminous fluid.	No bad effects followed, and the patient left the hospital perfectly cured	Cure	Récamier, 'Rev. Méd.,' 1825, t. i, p. 28; Cruveilhier, 'Diction. de Méd. et Chir.,' t. i, Art. "Acéphalocystes," p. 230; Barrier, Thèse, Paris, 1840, p. 57; Davaine, obs. cclvii, p. 568.
13	F. adult, pregnant	Large hydatid cyst on right side of abdomen. Tapped with common trocar, and issue of—	A large quantity of purulent fluid and broken hydatids	Recovered somewhat from the operation, but after 2 or 3 weeks miscarried, sank, and died	Death	Dr. Cholmely; Dr. Bright, 'Abd. Tumours.' Syd. Soc. ed., p. 41; 'Guy's Hosp. Rep.,' vol. ii.
14	F. adult	Fluctuating tumour of epigastrium. Punctured with small trocar, and issue of—	4 pints of limpid colourless fluid	For a long time after, the cyst appeared to refill gradually; at the time the account was closed there was no reaccumulation	Recovery	Mr. Key; Dr. Bright, 'Abd. Tumours,' Syd. Soc. ed., p. 42; 'Guy's Hosp. Rep.,' vol. ii.
15	F. 30	Exploratory puncture below left false ribs, and issue of— 7 days after, a fresh puncture 2 months afterwards, a third puncture, to the right of the umbilicus	About 3 pints of clear fluid Both the second and the last puncture were "without result"	Relief; diminution of tumour. Death 2 months afterwards from extension of another hydatid tumour through the diaphragm and rupture into the lungs. The cyst which had been tapped was diminished in volume	It is not stated whether any communication existed between the two tumours Death	Gonpil, in a Thesis by Cadet de Gassicourt, 'Sur la Rupture des Kystes hydatiques du Foie,' Paris, 1856, No. 50, p. 46; Davaine, obs. lxxvi, p. 447.

No.	Sex and age.	Situation of the tumour and treatment.	Nature and quantity of fluid withdrawn at the operation.	Progress.	Result and remarks.	Reference to author.
16	M. 42	Large tumour of right hypochondrium. Punctured with a very small exploratory trocar, and removal of about—	12 ounces of clear fluid	Syncope, rigors, bilious vomiting, collapse, and death 18 hours afterwards. The right lobe of the liver contained a cyst capable of holding about 9 pints	Death	J. Moissenet, 'Arch. Gén. de Méd.,' Fév., 1859, p. 144; Davaine, obs. cclvi, p. 567.
17	F. 19	Tumour of epigastrium. Punctured with capillary trocar	About a pint of clear water	No bad effects followed; the tumour disappeared, and had not returned 3 years after the operation	Radical cure	A. A. Boinet, 'Traitement des tumeurs hydatiques du Foie,' obs. v, p. 13, Paris, 1859; Davaine, obs. cclxii, p. 570.
18	F. 35	Tumour of right hypochondrium. Punctured with capillary trocar	About 4 ounces of clear fluid	Disappearance of tumour; no return after three years	Radical cure	Boinet, op. cit., obs. vi, p. 14; Davaine, obs. cclxiii, p. 570.
19	M. 34	Tumour in region of liver. Punctured by a very fine trocar; 7 days after, application of caustic potash	Limped hydatid fluid, quantity not stated	The tumour was redistended with fluid 3 days after the puncture. The caustic potash did not open the tumour. Nervous symptoms supervened	Death 25 days after the puncture	Récamier; Cruveilhier, 'Dict. de Méd. et de Chir.,' Art. "Acéphalocystes," t. i, p. 235; Davaine, obs. cclxxxiv, p. 590.
20	F. 33	Tumour occupying epigastrium and both hypochondria. Punctured in the epigastrium with a small	More than two pints of clear fluid	Progressed well; the remaining fluid was absorbed; there was no reaccumulation	Scarcely any remains of the tumour 3 months after recovery	Mr. Jonathan Hutchinson, 'Brit. Med. Jour.,' Feb. 20, 1864.

		exploratory trocar, and then, on the issue of a little clear fluid, with one the size of a No. 4 catheter			Cure	
21	F. 36	Large hydatid tumour in right lobe of liver, lifting the lower ribs. Punctured at most prominent part with a trocar the size of a No. 3 catheter	3 pints of clear fluid	At first febrile symptoms from peritonitis or inflammation of the cyst, which became distended and tympanitic. Recovery in 6 weeks, and when seen, some months after, she was wholly free from the disease	Radical cure	Mr. Jonathan Hutchinson, 'Brit. Med. Jour.,' Feb. 20, 1864.
22	M. 46	Tumour distending right hypochondrium and epigastrium. Punctured with trocar the size of a crow-quill at the outer margin of the rectus muscle, 2 inches below the margin of the ribs	6 pints of clear watery fluid	After 3 days, pain in region of the liver and repeated rigors. The febrile symptoms subsided, and a permanent cure resulted in 3 months' time	Cure	Frerichs, 'Dis. Liver,' Syd. Soc. ed., vol. ii, p. 268.
23 and 24	—	Professor Langenbeck communicated two cases of echinococci of the liver treated by simple puncture	—	No history, but both cases are said to have been cured	Cure Cure	Frerichs, loc. cit., p. 269.

No.	Sex and age.	Situation of the tumour and treatment.	Nature and quantity of fluid withdrawn at the operation.	Progress.	Result and remarks.	Reference to author.
25	F. 31	Tense fluid tumour of right hypochondrium. Tapped with trocar not quite so large as No. 1 catheter	About 12 ounces clear fluid	Three days after, fever and tympanitic distension of abdomen. Left bed on the 10th day, and the hospital on the 32nd, when the tumour was soft, free from tension, and gradually diminishing. Six months afterwards had almost regained her ordinary health. There was still a fulness in the region of the tumour, but the lower margin of the liver was quite an inch above the umbilicus	Recovery, with a portion of the tumour remaining 6 months after	Charles Murchison, M.D., 'Edin. Med. Jour.,' Dec., 1865, Case 1, p. 503.
26	M. 35	Large tumour of right hypochondrium. Punctured with a grooved needle, and issue of— About 6 weeks after, tapped with ordinary trocar, and issue of—	1 ounce of limpid fluid 23 ounces of limpid fluid	No bad effects followed either operation. After the second, the cyst immediately collapsed and did not refill. 3 months after the operation he had recovered health and strength, and there was no external indication of the former cyst	Cure	Dr. William Budd, 'Brit. Med. Journ.,' 1859, p. 273.

27	M. 37	Fluctuating tumour of epigastrium and right hypochondrium. Puncture of right hypochondrium with capillary trocar and injection of a mixture composed of ʒiss each tinct. iodine and water, and ʒss of iodide of potassium. The injection left in the cyst and the canula withdrawn	About 1½ pint of clear fluid	No pain followed the injection, but an hour afterwards symptoms of iodism and considerable general reaction, which continued for 5 days. Improvement from this time. A month after the operation the prominency of the hypochondrium was very little marked, and the general state satisfactory	Recovery, with a portion of the tumour remaining	Dr. Aran, 'Bull. Thérap.,' Sep., 1854, t. xlvii, p. 218; 'Arch. gén. de Méd.,' 5e série, t. iv, p. 477; Boinet, 'Iodothérapie,' Paris, 1855, p. 396; Davaine, obs. cclxxxviii, p. 595.
28	M. adult?	Hydatid tumour of liver. Exploratory puncture, which gave issue to—	A transparent hydatid fluid	The tumour never reappeared, "and after several years the cure is not to be denied"	Recovery	M. Robert, 'Soc. de Chirurg.,' 18 Mars, 1857, p. 381; 'Gaz. des Hôp.,' 1857, p. 147; Davaine, op. cit., obs. cclxi, p. 570.
29	F. —	A similar case to No. 28, similarly treated	A transparent hydatid fluid	Progress similar	Recovery	M. Robert, 'Soc. de Chir.,' Mars, 1857, p. 381.
30	F. 18	Fluctuating tumour of the epigastric and right hypochondriac regions. Puncture with ordinary trocar, and removal of—	About 1½ pint of faintly greenish watery fluid	For some days prostration and tendency to sickness. In a week substantial recovery. On the 21st day the sac had contracted to half its original capacity. 7 weeks after, the contraction was still more evident, and she was discharged cured in about 3 months after the operation. The patient was seen three months afterwards, and a still further contraction was observable; she remained quite well and able-bodied	Recovery, with some remains of the tumour	W. Brinton, M.D., 'Lancet,' 1862, vol. ii, p. 639.

No.	Sex and age.	Situation of the tumour and treatment.	Nature and quantity of fluid withdrawn at the operation.	Progress.	Result and remarks.	Reference to author.
31	F. 40	Growing tumour in left lobe of the liver the size of a young child's head. Puncture with an exploratory trocar two fingers' breadth below ribs in left hypochondrium, removal of nearly— Injection of ʒij of alcohol within the sac, and rapid withdrawal of the canula	2 pints of fluid	The tumour began to reappear 2 days after the operation. On the 3rd and 5th days vomiting; 6th, improvement, but appearance of jaundice; 8th, marked improvement; jaundice disappeared in 5 days, when the tumour had attained its original size. From the 18th day gradual diminution, and 3 months after, no appreciable traces of the tumour	Recovery This patient had previously undergone an operation upon a tumour in the right hypochondrium. (See case 81)	Adolphe Richard, 'Bull. gén. de Thérap.,' 1855, t. xlviii, p. 414; Davaine, op. cit., obs. ccxcvii, p. 606; 'Med.-Chir Rev.,' 1856.
32	F. 28	Fluctuating tumour of the liver. Application of caustic potash to the integuments covering its most prominent part; subsequent tapping of the cyst, and issue of—	2 pints of serous fluid	The day after the operation, jaundice, rigors, and symptoms of inflammation of the cyst. Peritonitis for 6 weeks, slight amelioration, afterwards persistent vomiting, and death. A large hydatid cyst was found in the liver, the intestines were matted together, and the	Death. It appears that no attempt was made to relieve the sac of its contents after the first puncture, and that the hydatid fluid escaped into the peritoneal ca-	Dr. Rogers, 'Brit. Med. Journ.,' 1862, vol. i, p. 71.

				peritoneum was studded with cysts	vity, causing peritonitis, and extension of the disease.	
33	M. 37	Fluctuating tumour in the liver. Puncture with a capillary trocar, and injection of a mixture of ʒiss each of tinct. iodine and water, with ʒss iodide of potassium	1¼ pint of clear watery fluid	Some reaction at first, then diminution of the size of the liver. A month after the operation the prominency of the right hypochrondrium was very little marked	Recovery, with a portion of the tumour remaining	Dr. Aran, 'Des injec. iodées dans les Kystes hydatique du foie Bull. Thérap.,' Sept., 1854, t. xlvii, p. 218; Davaine, obs. cclxxxviii, p. 595.
34	F. 21	A large deep-seated tumour in the right hypochondrium. Punctured with a fine trocar, and a mixture composed of ʒss each of extract of male fern, and solution of caustic potash, and ʒvj of water injected into the sac	ʒiv limpid colourless fluid, containing hooklets	At first febrile action, vomiting and purging. The tumour diminished, and she left the hospital on the 23rd day.	Recovery, with a portion of the tumour remaining	Dr. Pavy, 'Med. and Chir. Trans.,' vol. xlix.

TABLE II.—*Cases in which the cyst was punctured twice or oftener in succession, the opening being allowed to heal up directly after each operation.*

A. *Without injection.* B. *With injection of irritating fluid into the cyst.*

No.	Sex and age.	Situation of the tumour and treatment.	Nature and quantity of fluid withdrawn at the operation.	Progress.	Result and remarks.	Reference to author.
35 A	M. 31	Tumour occupying right hypochondriac and epigastric regions, and extending to the left hypochondriac, umbilical, and right lateral regions, the edge being level with the umbilicus. Tapped 5 times within six weeks	About 8 pints of fluid removed at each operation	Relief after the tappings; reaccumulation of fluid. About two months after the first tapping and a fortnight after the last the patient began to expectorate hydatid fluid in large quantities, and died 3 days after. The hydatid cyst in the liver had made an opening in the diaphragm and burst into the lungs	Death. No case could better illustrate the necessity of preserving an external opening, for even after the fifth tapping, the distended sac burst into the lungs	Dr. S. O. Habershon, 'Guy's Hosp. Rep.,' 3rd series, vol. vi, p. 174.

36 A	M. 45	Fluctuating tumour of liver, the size of a child's head. Puncture with an exploratory trocar, and removal of the greater portion of the fluid. After 6 days a second puncture with a larger trocar	About a pint of limpid fluid withdrawn by the first operation. No fluid followed the second puncture	No bad effects followed the punctures, and the patient left the hospital cured	Recovery	Demarquay. A.A.Boinet, op. cit., p. 30; Davaine, obs. cclxiv, p. 571.
37 A	M. 20	Elastic fluctuating tumour of the epigastrium punctured twice, at an interval of 4 months, with a capillary trocar	About a pint the first operation, and 15 ounces the second. Limpid, clear fluid on both occasions	For some time after the first tapping the cure appeared radical, but 4 months afterwards there was a distinct swelling. The second operation appeared to effect a complete cure	Recovery	A. A. Boinet, op. cit., obs. viii, p. 18; Davaine, obs. cclxviii, p. 576.
38 A	M. 26	Swelling on the left side below the ribs, extending across the epigastrium to the right hypochondrium. Tapped 5 times within a month	Quantity not stated; the fluid was at first clear, but on the four subsequent occasions it was purulent	Reaccumulation of the fluid after each tapping. After the last "the liver began to swell," and the patient died 34 days after admission. Large hydatid cyst of the liver containing 4 secondary cysts, each holding a pint of perfectly clear fluid	Death. This case shows how rapidly the fluid may reaccumulate, and it is to be observed that the contents of the sac were purulent when the second puncture was made.	Dr. Willtshire and Mr. Canton, 'Lancet,' Sept. 1, 1860.

No.	Sex and age.	Situation of the tumour and treatment.	Nature and quantity of fluid withdrawn at the operation.	Progress.	Result and remarks.	Reference to author.
39, 40, and 41 A	—	Three cases of small hydatid tumours of the liver treated by successive puncture with an exploratory trocar	2 ounces of fluid withdrawn each time	In two cases a gradual diminution in the size of the cyst was to be traced for a long time afterwards. The third case was lost sight of	Recovery, with some portions of the tumour remaining	Frerichs, op. cit., vol. ii, p. 256.
42 and 43 A	—	Two cases of large hydatid tumour of the liver treated by successive puncture with an exploratory trocar	2 ounces of fluid withdrawn each time	Both cases quite unsuccessful; the cysts went on growing without interruption	Operation ineffectual	Frerichs, op. cit., vol. ii, p. 256.
44 A	M. 58	Fluctuating tumour of the epigastrium tapped with a small trocar in median line 2 inches above the umbilicus. 6 days after, tapped a second time	1½ pint of a turbid yellowish fluid the first time; a still larger quantity the second	No relief, and death 10 days after the first operation	Death	Mr. Moreton, of Tarvin, and Dr. Dobie, of Chester; Murchison, 'Edinb. Med. Journ.,' Dec., 1865, case vi, p. 509.
45 A	F. 34	Tumour the size of a child's head below the false ribs on the right side. Puncture with a	After first puncture, 6 ounces of clear limpid fluid. After the second, 6 to 8	2 days after the second puncture, shivering, great febrile disturbance, pain in the epigastric region,	Recovery	M. Jobert, Barrier, Thèse cit., p. 83; Davaine, obs. cclvi, p. 573.

		very fine trocar, and retention of the canula until the morrow. 9 weeks afterwards, a second exploratory puncture. 3 weeks later, a third was made across an eschar produced by caustic potash. A medium-sized trocar was used this time, and the canula retained until the morrow. An elastic catheter was introduced on two occasions, the same and the following day, but was not retained	ounces of a similar fluid. After the third, 8 to 10 ounces of a turbid, brownish, purulent fluid	and tenderness of the abdomen. Recovery in 3 days. 4 days after the third puncture the wound was closed, and the discharge was completely suspended. On the 6th day, shivering and fever with pain, tenderness and swelling in the hepatic region. Rapid subsidence of these symptoms; the wound cicatrised in the course of a few days, and the tumour did not increase, but appeared to decrease a little. 7 weeks after the last puncture, she was restored to health and at work, and there was no apparent enlargement of the liver		
46 B	M. adult	Tumour of right hypochondrium, exploratory puncture. Two applications of Vienna paste and puncture through the eschar with a fine trocar and injection of iodine	A clear limpid fluid followed the first puncture; a turbid one the second	Some days after the second puncture the tumour reappeared, febrile symptoms were set up and continued for several months. Ultimately, slow amelioration and cure	Recovery	Chassaignac, 'Gaz. des Hôpitaux,' 1857, p. 147, et "Leçon cliniq.," p. 366, same journal; Davaine, obs. ccxc, p. 597; 'Bull. de la Soc. de Chirurg. de Paris,' 1856-7, p. 380.

No.	Sex and age.	Situation of the tumour and treatment.	Nature and quantity of fluid withdrawn at the operation.	Progress.	Result and remarks	Reference to author.
47 B	M. 31	Tumour of the hypochondria, punctured with a capillary trocar, and issue of—	From ʒxij to ʒxiv of clear fluid	No bad effects appeared to have followed the punctures, all of which were made with a capillary trocar. The first puncture was followed by a great diminution of the swelling and hepatic dulness, but the others had no apparent effect in diminishing the size of the tumour. No pain was caused by the injection, and 2 months afterwards the patient was discharged cured. At the time of his discharge the liver projected from 2½ to 3 fingers' breadth beyond the margin of the ribs	Recovery, with a portion of the tumour remaining	Dr. Aran, 'Bull. thérap.,' Sept., 1854, t. xlviii; Davaine, obs. ccxcii, p. 599.
		18 days after, a second puncture, and issue of—	about ʒx of turbid liquid			
		32nd day a third puncture, and discharge of—	from ʒiij to ʒiv of slightly turbid fluid			
		60th day a fourth puncture, and issue of about—	ʒiv fluid			
		70th day a fifth puncture, and issue of—	about 1¼ pint of reddish-yellow turbid fluid			
		84th day a sixth puncture, and discharge of—	ʒij of turbid fluid			
		95th day a seventh puncture, and issue of about—	1¼ pint of turbid fluid			
		115th day an eighth puncture, and—	no result			
		123rd day a ninth puncture, and issue of about—	ʒxiij of turbid sanguinolent fluid			
		140th day a tenth and last puncture; evacuation of—	about ʒx of similar fluid			
		Injection of cyst with a mixture of ʒiss each tinct. iodine and water, and ʒj of iodide of potassium				

TABLE III.—*Cases in which the tumour was punctured, once or oftener, and an external communication established at once or subsequently.*

A. *No injections employed.* B. *Injection of irritating fluids into the cyst.*

No.	Sex and age.	Situation of the tumour and treatment.	Nature and quantity of fluid withdrawn at the operation.	Progress.	Result and remarks.	Reference to author.
48 A	M. 31	Tumour of epigastrium and right hypochondrium, encroaching 2 inches to the left of the median line, and below into the umbilical and right iliac regions. Tapped with exploratory trocar midway between umbilicus and cartilage of ninth rib. A month after, tapped again with a small trocar, and two days after with a full-sized trocar; an elastic catheter introduced, and the canula withdrawn	On first tapping, 38 ounces of clear liquid. On the second, 10 ounces of fœtid pus. On the third, 39 ounces of fœtid pus and broken-down hydatids	Discharge of fœtid pus and membranous flakes of hydatids for 3 months. Gradual contraction and disappearance of the sac; healing of the fistulous opening, and cure	Radical cure. It is to be observed that fœtid pus escaped on making the second puncture	Dr. Owen Rees, 'Guy's Hosp. Rep.,' ser. ii, vol. vi, p. 17, 1848-9; 'Lond. Med. Gaz.,' vol. xliii, p. 1101, 1849; 'Bull. de Thérap.,' 1848, t. xxxv, p. 331; 'Arch. gén. de Méd. de Paris,' Juillet, 1849, p. 346; Davaine, obs. cclxvii, p. 576.

No.	Sex and age.	Situation of the tumour and treatment.	Nature and quantity of fluid withdrawn at the operation.	Progress.	Result and remarks.	Reference to author.
49	M. 36	Tumour commencing an inch above the umbilicus, and extending over the abdomen. Punctured with a small trocar several times within 11 weeks. Afterwards a small quantity of fluid was drawn off every third day. Ultimately the opening was enlarged with a bistoury, and a large canula introduced	½ a pint of clear fluid followed the first puncture. 4 pints of similar fluid followed the second. About the same quantities of turbid brownish fluid followed the subsequent punctures	The patient progressed favorably, the discharge ultimately became quite purulent and fœtid, but it was only after enlarging the opening that the evacuation of the broken-down cysts was effected, a fistulous opening was established, and the sac slowly contracted	Radical cure	Dr. Babington and Mr. Cock; Dr. Habershon, 'Guy's Hosp. Rep.,' vol. vi, 3rd series, p. 179; 'Med. Times and Gaz.,' 1856.
50 A	M. 15	Prominent fluctuating tumour, the size of a fist, on the right side of the abdomen. Puncture through eschar formed the previous day by caustic potash. An elastic catheter placed in the wound until the morrow	½ a pint of limpid fluid followed the puncture, and the catheter gave issue to a glassful more	Escape of fragments of an hydatid cyst through the wound for a few days. Slight erysipelas of the wound. Subsequently bilious vomiting and fever for some hours. Gradual subsidence of the tumour, cicatrization of the wound, and cure in about three months	No particular care appears to have been taken to keep the wound open, and it opened and closed again several times before it finally healed. The constitutional disturbance was doubtless due to the tem-	MM. Richerand and Jobert; Barrier, 'De la Tumeur hydatique du Foie,' Thèse, Paris, 1840, p. 90; Davaine, op. cit., obs. cclxv, p. 572.

					porary closure of the wound. Cure	
51 A	F. 19	Large tumour of the epigastrium, punctured in the centre with a capillary trocar. 23 days afterwards, a second tapping and attempt to close the wound	On first puncture, 4 ounces of clear fluid. On the second, 6 to 8 ounces of thick fœtid pus	4 days after the first operation, rigors and distension of the tumour, slight tympanites. After the second tapping, the tumour again became distended, and caused the wound to give way on the 5th day, when there was a discharge of air and fœtid pus. The discharge continued for the next 2½ months, at the end of which time the patient was gaining flesh and strength, and the opening was discharging still	Radical cure? In this case the necessity for a free external opening is well seen. It will be further observed that the effect of the first puncture was to convert a clear fluid within the sac into a thick fœtid pus	Dr. Garrod, 'Lancet,' Sep. 1, 1860, p. 210.
52 A	F. 22	Inferior part of right side of the chest distended by fluid supposed to be contained in the pleuritic cavity. Tapped with ordinary trocar	A small quantity of glutinous fluid escaped on puncture	Discharge of similar fluid and hydatid membranes continued; and on the 33rd day after tapping, a large quantity of pus and hydatid membranes came away. She was discharged cured on the 43rd day?	Radical cure? Observation of the case not sufficiently prolonged.	Dr. Goolden, 'Lancet,' Sep. 1, 1860, p. 210.

No.	Sex and age.	Situation of the tumour and treatment.	Nature and quantity of fluid withdrawn at the operation.	Progress.	Result and remarks.	Reference to author.
53 A	M. 59	Tumour in epigastric and hypochondriac regions. Punctured with a small trocar; 7 days after, punctured again with a much larger trocar; the canula withdrawn, and a flexible tube the size of the trocar retained in the wound. The tube became obstructed, and was removed 5 days after, and the wound kept open by oiled lint	9 drachms of slightly turbid fluid followed the first puncture, and a little clear fluid and hydatids the second	After the insertion of the tube, only a little discharge oozed from the sac by the side of the catheter, and there was some constitutional disturbance. The tube was blocked up by a collapsed hydatid. After the removal of the tube, broken hydatids and fœtid pus continued to be discharged for about 5 weeks, gradually decreasing in quantity. On the 79th day from the first puncture, he was in perfect health, and a cord-like cicatrix occupied the place of the former opening	Radical cure	Dr. Owen Rees, 'Lond. Med. Gaz.,' vol. xliii, p. 1101, 1849.
54 A	M. 42	Enormous tumour occupying the epigastric and hypochondriac regions, and reaching as low as the umbilicus. Tapping with a trocar; and 10 days	At the first operation, only a little pus was obtained by means of a cupping-glass. At the second operation, offensive	In the interval between the first and second operations, the tumour increased in size, and the presence of air was manifest. Inflammatory symp-	The cyst in this case was not permanently relieved of its contents. Putrid fever ap-	Mr. Hilton, 'Lancet,' 1851, vol. i, p. 353.

		after, an incision, ¾ inch long, was made down to the cyst, and a trocar and canula then plunged into it. A plug of lint was placed in the wound	gas and a number of hydatid cysts were removed; and 5 days afterwards, 1½ pint of purulent fluid was discharged	toms supervened. After the second puncture, hydatids were freely discharged with purulent fluid. The patient lingered for a few days, and died about three weeks after the first operation. An hydatid cyst, full of putrid hydatids, was found in the left lobe of the liver	pears to have been set up, resulting in death	
55 A	M. 12	Fluctuating tumour in the hepatic region. Incision and evacuation of— The lining membrane of the cyst was withdrawn by gentle traction	8 pounds of clear fluid	Inflammation and suppuration of the cyst followed the complete evacuation of its contents, and the cure was completed in 10 weeks	Radical cure promptly effected by the rapid and complete evacuation of the cyst	Dr. A. Monro, 'Morbid Anatomy of the Gullet;' 'Prov. Med. and Surg. Journ.,' vol. xiv, 1850, p. 394.
56 A	M. 56	Small hydatid tumour of the liver, occupying the epigastric and right hypochondriac regions. Exploratory puncture with grooved needle. The following day, a crucial incision over the most prominent part of the tumour; and after the flaps were dissected back, caus-	A little viscid serum containing hooklets was obtained by the grooved needle, and one ounce of viscid substance, consisting of broken hydatids and serum, was obtained at the time of tapping	Considerable pain and restlessness followed the introduction of the trocar. After the opening was dilated, from ʒiv to ʒviii of sanguinolent viscous matter, crowded with hydatid cysts, were discharged daily for 10 weeks, during which time the patient remained in a very	This is a capital illustration of the progress towards radical cure in the case of a small tumour. It also shows the necessity of evacuating the contents of the cyst as	J. Hughes Bennett, M.D., 'Princ. and Prac. Medicine,' 4th Edit., p. 522.

No.	Sex and age.	Situation of the tumour and treatment.	Nature and quantity of fluid withdrawn at the operation.	Progress.	Result and remarks.	Reference to author.
		tic potash was applied to the subjacent tissue. On the 9th day, a second application of the caustic. On the 11th, a trocar and canula, ½rd inch in diameter, were passed through the slough into the tumour, and a scooped director used to evacuate its contents. 16th day, dilatation of the wound, and the insertion of tents of lint to preserve the opening		weak condition. A tough membrane was subsequently evacuated, and henceforward the discharge rapidly decreased, and in about 14 weeks from the time of puncture with the trocar the wound was quite healed. A month afterwards there was no trace of any hepatic tumour, and the patient was in perfect health	soon as possible. After the discharge of the membrane lining the parent cyst, there was a speedy recovery. Radical cure	
57 A	M. 10	Hydatid tumour of the liver tapped with a large trocar, and the opening preserved	Discharge of a large quantity of turbid fluid and cyst-wall	Portions of cyst were subsequently discharged in larger quantities, and the patient made a good recovery	Cure, probably radical	Dr. Hjaltalin; Dr. Leared, 'Path. Soc. Trans.,' vol. xiv, p. 176.
58 A	F. 31	Fluctuating tumour commencing in the right hypochondrium, and extending over the whole of	On first tapping, only a few ounces of pus; a few hours after, 16 pints of purulent	Immediate relief, rapid recovery of health and strength. The discharge gradually decreased to a	If we accept the patient's statement that the tumour com-	A. Copeland Hutchison, 'Practical Observations in Surgery,' London, 1816, p. 145.

		the abdomen; most prominent part a little to the right of the ensiform cartilage. Puncture with large-sized trocar, and retention of the canula. Introduction of a probe through the canula to push away or rupture the secondary cysts. Canula stopped with a cork during daily intervals. Removal of the canula after five days, and substitution of a sponge-tent	fluid and hundreds of small hydatids. Subsequently the daily discharge of large quantities of fluid	few drachms daily. More than 18 months after the operation, nearly 2 quarts of healthy pus, free from hydatids, were discharged. A year afterwards, a fistulous opening remained, but there was no appreciable discharge	menced in the right hypochondrium, and take into account the upward displacement of the diaphragm and the deficiency of bile in the fæces, we may assume that the disease had its origin in the liver; but no mention is made of the condition of that gland Radical cure	
59 A	M. adult	Large fluctuating tumour bulging the right hypochondriac and epigastric regions, supposed to be an abscess. Incision through the integuments covering the most prominent part of the tumour, and puncture of the cyst with a full-sized trocar, and evacuation of— Canula withdrawn, and opening closed with sticking-plaister	6 pints of sero-purulent fluid and small hydatids	Pain and febrile symptoms followed the 1st operation, and on the 7th day the tumour had regained its previous size. The same occurred after the second puncture, and, although one puncture at least remained open, after the 13th day it was necessary to make the other openings in order to give vent to accumulating fluid, and it was only after the	This case illustrates very completely the dangers resulting from obstruction of the discharge, and the advantages of making free openings into the sac Radical cure	H. C. Sherwin, 'Edin. Med. and Surg. Journal,' 1823, vol. xix, p. 228.

No.	Sex and age.	Situation of the tumour and treatment.	Nature and quantity of fluid withdrawn at the operation.	Progress.	Result and remarks.	Reference to author.
		On the 7th day, second puncture an inch higher with a very large round trocar, and the withdrawal of— This opening was also healed On the 13th day, trocar introduced a third time, and the canula retained and plugged On the 24th day a fourth tapping, and on the 32nd day a fifth tapping, were resorted to, and— On the 39th day, an incision an inch long was made between the 9th and 10th ribs, behind their angles, and a large round trocar introduced in a direction pointing to the scrobiculus cordis. The canula was retained for 10 days, a thick piece of wax bougie was then substituted	10 pints of sero-purulent fluid and hydatids 8 pints of purulent fluid and hydatids were obtained by the third operation Several pints of purulent fluid removed 6 pints of very fœtid pus and some larger hydatids, and towards the end a little bile, were obtained by this last puncture	6th operation that this was sufficiently secured. The discharge then rapidly decreased, the sac contracted, and the patient recovered his health and strength and returned to his work 3 months after the operation. 7 weeks after this date, the sac was entirely obliterated, and nothing remained but a slight fistulous opening		

60 A	M. 38	A large circumscribed fluctuating tumour in the right hypochondrium, extending to the umbilical region. Previously to the operation, jaundice, great pain in the tumour, shivering, and increase of the tumour. Puncture, and the application of poultices to the punctured part	A gallon of thin, purulent, offensive matter and hydatids followed the withdrawal of the instrument	Hydatid membranes and a yellowish green tenacious fluid continued to be discharged. Tenderness and pain in the tumour increased, and the patient died on the 26th day after the operation. An immense cyst, full of numerous large hydatids, was found in the right lobe of the liver	No means appear to have been adopted to secure the evacuation of the contents of the cyst, and the fatal result is attributable to retention of the discharge Death.	John Elliotson, M.D., F.R.S., 'Lancet,' vol. i, 1832, p. 756.
61 A	F. 20	Painful tumour in the right hypochondrium, indistinctly fluctuant. Puncture, and withdrawal of—	10 ounces of bloody pus and hydatids	Relief. The puncture was healed on the 3rd day, and the tumour refilled. On the 11th day the integuments gave way, and a considerable quantity of matter was discharged. On the 17th day the opening was healed and the cyst contracted	In this case the accumulated fluid produced sufficient distension to effect spontaneous rupture, and the safety of the patient was thus secured. Cure	Dr. Cholmeley, 'Lancet,' 1826.
62 A	F. 62	Tumour of the liver extending from the right lumbar region across the abdomen to 2 inches left of the umbilicus, and upwards as far as the 7th rib. Puncture, and the opening preserved by lint tents and simple dressing	4 pints and a few ounces of offensive pus and hydatids followed the withdrawal of the instrument	At first moderate febrile action, but on the 4th day it had ceased, and the patient was in a very favorable condition, and there was great discharge from the wound	The history stops short on the 4th day; but from the plan of treatment adopted and the freedom of the discharge, it is probable that the patientrecovered	Dr. Roberts, 'Lancet,' 1834, vol. i, p. 189.

No.	Sex and age.	Situation of the tumour and treatment.	Nature and quantity of fluid withdrawn at the operation.	Progress.	Result and remarks.	Reference to author.
63 A	M. 25	Fluctuating tumour of the right hypochondrium. Two applications of Vienna paste; puncture through the eschar with an ordinary trocar. A second puncture 3 months afterwards; closure and cicatrization of the opening. Subsequent rupture thro' the cicatrix, and establishment of a fistulous opening	5¼ pints of clear fluid followed the first puncture. Pus and broken-down hydatids followed the second	Reaccumulation took place after both punctures. The spontaneous rupture was followed by the discharge of fœtid fluid and hydatids. Exhaustion and death 5 months from the time of the first operation. A hydatid cyst, the size of an adult's head, and a second smaller one, were found in the liver	Even the ruptured opening was insufficient to secure the evacuation of the contents of the cyst, and no means appear to have been used to evacuate the secondary cysts. Death	Cruveilhier, 'Gaz. des Hôpit.,' 1842, 2e séries, t. iv, p. 317.
64 A	M. 38	Tumour of epigastrium, exploratory puncture. Two applications of caustic potash, and eight days after the last one incision through the eschar. A month afterwards a fresh puncture, and the opening preserved by means of a sponge-tent	A little clear fluid followed the exploratory puncture, and half a pint of turbid serosity the incision. On making the last opening, a most fœtid fluid and hydatids escaped	On the 22nd day the tumour had nearly disappeared, but the patient continued in an unsatisfactory state. On the 45th day the belly was still a little painful and distended. The last opening produced immediate relief; a free outlet was maintained, and the patient progressed satisfactorily, and the cyst was diminishing every day	Radical cure	Récamier, 'Lond. Med. Gaz.,' vol. ii, p. 573, 1828, 'La Clinique,' May 6. 1828 (?); 'Lancet,' 1827-8, vol. ii, p. 327 (?).

65 A	F. adult	A case of supposed hydrothorax. Puncture between the lower false ribs of the right side, and a tent placed in the wound	Fluid and hydatids	The patient died very quickly. The thoracic organs were healthy, but the liver was in great part destroyed by a hydatid cyst	Death	Ruysch, 'Obs. Anat. Chirurg.,' obs. lxv, p. 61, cit. par Lassus. Mém., cit., obs. v; Cruveilhier, op. cit., p. 229; Davaine, obs. cclxxv, p. 581.
66 B	M. 30	Circumscribed tumour of the right hypochondrium. Exploratory puncture, and— 6 applications of caustic potash; incision of the eschar, and evacuation of— A tent placed in the wound. Occasional introduction of an elastic catheter, and washing-out of the cyst. Injection of tincture of iodine	Issue of about 4 ounces of watery fluid. 1¾ pint of turbid, fetid, yellowish serosity	After the puncture, there were vomiting, fever and exquisite sensibility of the belly. These symptoms abated, but returned with great severity after the 6th application of caustic potash, and the tumour increased in size. The patient remained in a precarious state after the incision, but 3 months subsequently he had regained his flesh and strength. The fistula gradually closed, and the patient was cured in about 4 months	Radical cure	Robert, 'Bull. gén. de Thérap.,' Paris, 1843, t. xxv, p. 379; Davaine, obs. ccxciv, p. 601.
67 B	F. 8½	Tumour of epigastrium, capillary puncture, and removal of about— 16th day, a second puncture, with medium-sized trocar; issue of— Injection of iodine; soon	2 pints of clear hydatid fluid 2 pints of green purulent matter 2 pints of fœtid	No bad effects followed until the 10th day, when, the sac having refilled, severe febrile symptoms supervened. The second operation gave complete relief, but as the sac filled	Radical cure. In this case the tumour, although small, twice became redistended, and it was necessary	Dr. Boinet, 'Gaz. hebdomad. de Méd. et de Chir.,' sér. 2, 1864, tom. i, p. 86. The author records another successful case similarly treated in the 'Gaz. Méd.,' 1860.

No.	Sex and age.	Situation of the tumour and treatment.	Nature and quantity of fluid withdrawn at the operation.	Progress.	Result and remarks.	Reference to author.
		after, application of caustic potash and chloride of zinc. 42nd day, puncture with a very large trocar, and evacuation of— Insertion and retention of a large elastic catheter. 49th day, another large puncture made into the cyst and drainage tubes kept in both openings. 64th day, incision into the cyst, and withdrawal of its contents	greenish pus and broken-down hydatids	again the dangerous symptoms reappeared. As soon as the external opening was freely established all went on well, and after the removal of the cyst membranes by incision the sac speedily contracted, and was completely obliterated on the 110th day	to establish a free external opening	
68 B	M. 33	Large tumour of right hypochondrium raising the walls of the chest, punctured with a common trocar, and issue of— The flow being arrested, the sac was opened at once with a bistoury and a dilator introduced. The sac was repeatedly injected with iodine	Several spoonfuls of pus and a hydatid. On making the incision, about 2 pints of pus and hydatid membranes were evacuated	The patient went on satisfactorily for nearly a month after the operation. Subsequently he had shivering, fever and fœtid stools, and died on the 42nd day. The punctured cyst contained yellowish brown liquid and two hydatids. It communicated with another cyst which occupied nearly the whole of the right lobe of the liver and extended through the diaphragm to the right lung	No mention made of any continuance of the discharge; but a month after the operation an hydatid was withdrawn from the wound; some very fœtid grumous discharge followed. Death	Mesnet and Boinet, 'Revue méd.,' 15 Février, 1853; 'Bull. Soc. Chir.,' 1852; Boinet, op. cit., p. 387; Cadet de Gassicourt, Thèse cit., p. 76; Davaine, obs. ccxci, p. 597.

69 B	F. 27	Hard tumour on right side of abdomen. Exploratory puncture and evacuation of— 2 days after, application of Vienna paste nearly midway between false ribs and crest of ileum. Repeated until the cyst burst spontaneously. This occurred on the 22nd day Injection of tinct. iodine through an elastic catheter. On the 24th day, removal of catheter and enlargement of the opening by a bistoury, and repeated injection of iodine	4 pints of clear fluid. Discharge of 4 pints of a reddish fluid	Rigors and rather severe fever, with bilious vomiting, came on after the first injection of iodine, but soon ceased. The contents of the cyst were gradually evacuated. The patient's state continued to improve until rather more than 3 months from the first puncture, and she was discharged cured	Radical cure	M. Demarquay, 'Gaz. Méd. de Paris,' Sept. 16, 1865; 'Brit. Med. Journ.,' Dec. 16, 1865, p. 642.
70 B	F. 16	Fluctuating tumour of right hypochondrium. Several applications of caustic potash; exploratory puncture, and 12 days after, puncture with a large trocar. Next day dilatation of the wound with prepared sponge. Injection of iodine on the 20th day. On the 28th, solution of nitrate of lead; and subsequently chlorinated water twice a day	2 spoonfuls of clear fluid followed the first puncture, 4½ pints of clear limpid fluid the second. Next day, fragments of hydatid cyst	Free discharge, at first of bilious fluid. On the 12th day it was purulent. In 2½ months the fistulous opening discharged only a few drops of serosity, and at the end of 4½ months she was perfectly cured and the fistula had healed	Radical cure	Laboulbène; Davaine. obs. cclxxxiii, p. 588.

No.	Sex and age.	Situation of the tumour and treatment.	Nature and quantity of fluid withdrawn at the operation.	Progress.	Result and remarks.	Reference to author.
71 B	M. 36	A tumour of considerable size in the hepatic region. Application of caustic potash until it was assumed that adhesions had taken place, then tapping with ordinary trocar. The sac washed out with water, injected with iodine, and an elastic catheter inserted and kept in the wound. Iodine and chlorine injections frequently used	1¾ pint of pus	The patient progressed well. Pus and débris of hydatids continued to be discharged. On the 11th day, bile was mixed with the pus. From the 13th to the 19th day, the discharge consisted of pure bile. Left the hospital on the 60th day, the fistulous orifice discharging a little pus. 5 months afterwards, the fistula was closed, the wound cicatrized, and the general health excellent	Radical cure	M. Nélaton; Cadet de Gassicourt, Thèse cit., obs. iii, p. 13; Davaine, obs. cclxxxix, p. 596.
72 B	F. 34	Fluctuating tumour of right hypochondrium. Three exploratory punctures at intervals of 20 days, and evacuation of about— Afterwards, 3 applications of Vienna paste; and on the 38th day after the last puncture, an opening	8 pints altogether of fluid; clear and albuminous on two occasions, purulent on the last. 3¾ pints of pus followed the fourth puncture	No bad symptoms followed the first two punctures; the third induced shivering and fever. Capillary punctures proved insufficient to produce contraction of the tumour. Some days before the wound was enlarged, grave febrile symptoms appear-	Radical cure. This case shows the insufficiency of repeated capillary punctures for the removal of a tumour of very moderate size	Demarquay, 'Gaz. des Hôpitaux,' 19 Février, 1859, p. 82; Davaine, obs. ccxcv, p. 603.

		was made with a bistoury, an elastic catheter introduced, and injections of iodine and perchloride of iron employed from time to time. On the 62nd day the opening was enlarged by a bistoury; withdrawal of the catheter on the 86th day		ed. This operation was followed by the ejection of pus and débris of hydatids, and an abundant flow of blood. 6 months after the first puncture, the patient was in a satisfactory state, and may be considered as cured		
73 B	F. 27	Tumour of right hypochondrium. Application of Vienna paste at intervals. 8 days after the last application, puncture with cataract needle. 3 days after, puncture with ordinary trocar through the eschar. The canula was withdrawn, but replaced again on the 5th day; but being too fine to allow a free flow, another puncture was made on the 8th day. Iodine injections were used on the 5th and subsequent days	5½ pints of very fœtid pus followed the second puncture; no fluid followed the third	Severe diaphragmatic peritonitis followed the exploratory puncture. No bad effect followed the tappings, but the flow of fluid was obstructed and the cyst became distended. On the 11th day febrile symptoms set in, and on the 12th the patient died. There was no adhesion between the abdominal wall and the cyst, which contained 5¼ pints of purulent serosity and hydatids. There was pus in the neighbouring hepatic veins	Death. 3 applications of Vienna paste at intervals of 3 days failed to produce adhesion of the sac	F. Dolbeau, 'Sur les grands Kysts du Foie,' Thèse, No. 113, obs. i, p. 25, Paris, 1856; Davaine, obs. ccxcvi, p. 604.

No.	Sex and age.	Situation of the tumour and treatment.	Nature and quantity of fluid withdrawn at the operation.	Progress.	Result and remarks.	Reference to author.
74 B	F. 53	Fluctuating tumour distending the lower ribs of the right side. Application of Vienna paste between the 8th and 9th ribs; 2 days afterwards, puncture through the slough with an exploratory trocar; 3 days after this, puncture with a large trocar, injection of bile morning and evening, and retention of the canula	After exploratory puncture, issue of clear water and minute hydatids. After the second puncture 3½ pints of straw-coloured clear fluid	The patient did well up to the 8th day, when the discharge failed; the next day there was diarrhœa and some fœtid discharge from the sac; fever and pneumonia followed, and the patient died on the 36th day. The cyst contained fluid and hydatids; there was some pneumonia of the left lung, calculi and distension of the gall-bladder, and ulcerations of the duodenum and small intestine	Death	Auguste Voisin, 'Bull. Soc. Anat.,' Paris, 1857, ann. xxxii, p. 132; Davaine, obs. ccxcviii, p. 608.
75 B	M. 29	Very large fluctuating tumour extending from the epigastrium over the whole of the abdomen and into the lower part of the chest, displacing the lungs and heart. Puncture with No. 11 trocar; maintenance of the opening by the	Discharge of 19½ pints of fluid, the greater part bright and clear as water, the latter portions tinged yellow and turbid from the presence of bile: and also a number of minute	Great relief and favorable progress, occasionally interrupted by distress and febrile symptoms due to retention of the discharge by the broken-down cyst-wall. Excepting at these times, the discharge was very profuse	Radical cure	Synopsis of the case related in this paper. 'Med. Times and Gaz.,' 1866, vol. i, p. 482; 'Lancet,' 1866, vol. i, p. 538; 'Gaz. Méd. de Lyon,' 1866.

		canula and by elastic catheters. Gradual dilatation of the passage by means of elastic catheters. Injection of a large quantity of iodine, and a daily cleansing of the cyst with a solution of zinc and creasote water	hydatid vesicles	and amounted to many gallons. For 21 weeks from the day of tapping, the discharge contained a considerable quantity of bile. On the 51st day there was hæmorrhage from the liver. On the 75th day the whole of the contents of the cyst were evacuated, and from this time the discharge decreased and cyst contracted, and ultimately disappeared		
76	F. 26	Fluctuating tumour of the upper part of the abdomen. Destruction of the integuments by caustic potash, and puncture of cyst with a capillary trocar; closure of the orifice and reopening by means of a bistoury, and insertion of an elastic catheter; frequent injection of iodine and alcohol. Catheter retained for four months	16 ounces by the first operation; 1¼ pint by the second	Intense general symptoms after the second operation. Subsequent evacuation of a great number of fragments of hydatid cysts. Closure of the fistula, and recovery of health in about 5 months from the first operation	Radical cure	M. Leudet, 'L'Union Médicale,' 1859, No. 90, p. 202.

No.	Sex and age.	Situation of the tumour and treatment.	Nature and quantity of fluid withdrawn at the operation.	Progress.	Result and remarks.	Reference to author.
77	F. 17	Hydatid tumour of the right hypochondrium. Incision down to the peritoneum, 7 days after, puncture with a flat trocar, and the wound closed. A second puncture on the 10th day, and the canula retained	2 pints of watery colourless fluid by the first puncture. ʒiv yellowish-brown turbid fluid by the second	Severe febrile symptoms followed the first puncture. Purulent fluid and hydatid membrane continued to be discharged. The tumour gradually subsided, and the fistula closed	Cure. The patient died 5 months after of phthisis	Ried and Brehme, 'Deutsche Klinik,' No. 39, p. 377 and 386.

TABLE IV.—*Cases in which the tumour was directly incised without previous puncture, or (excepting Case 89) the application of caustic potash, and an external communication preserved.*

No.	Sex and age.	Situation of the tumour and treatment.	Nature and quantity of fluid withdrawn at the operation.	Progress.	Result and remarks.	Reference to author.
78	M. 28	Fluctuating tumour of the posterior and inferior part of the right side of the chest. Incision about 1½ inch long between the third and fourth false ribs, in the centre of the tumour	At first limpid fluid; afterwards a great quantity of yellow pus, and for the next 12 days several hydatids with a great quantity of pus	15 days after the operation, precordial anxiety, painful cough and expectoration of hydatids. This continued to the 43rd day. On the 72nd day, the wound was reduced to a small fistulous opening, with only a slight suppuration of a healthy character, and the condition of the patient was improving from day to day	Radical cure	Fréteau, 'Journ. gén. de Sédillot,' t. xliii, p. 121; Cruveilhier, 'Dictionnaire de Méd. et de Chir. pratiq.,' t. i, art. 'Acéph.,' p. 249 (extract); Davaine, op. cit., obs. xxxiv, p. 415.
79	M. 37	Very large fluctuating tumour of the epigastrium and lower part of abdomen. Opened by incision with a scalpel 3 inches below the ensiform cartilage. The discharge being obstructed two days afterwards, the canula was again introduced into the wound	At first about 9 pints of fluid were evacuated. On reintroduction of the canula, 4 pints more	At first, relief; but, two days after the operation, return of the dyspnœa. After the reintroduction of the canula, there was a constant oozing until death, which took place 9 or 10 days afterwards. The cyst was found to contain nearly 14 pints of bloody serum, and there were 8 pints of viscid bilious fluid in the peritoneal cavity	Death. The fatal result was clearly due to overflowing of the fluid from the distended sac into the peritoneal cavity	Dr. Hastings, 'Midland Medical Reporter,' Aug. 1829; 'Trans. Med. and Chir. Soc.,' vol. xxiii.

No.	Sex and age.	Situation of the tumour and treatment.	Nature and quantity of fluid withdrawn at the operation.	Progress.	Result and remarks.	Reference to author.
80	M. 36	Fluid tumour of the epigastrium opened by an incision 2 inches long between the umbilicus and ensiform cartilage. A pledget of lint was placed in the wound	At first a quantity of hydatids and fluid equal to 12 pints	Progressed well; fluid and cyst-wall continually escaping. The fluid became extremely fœtid, and a month after the operation the patient was very weak. During the second month there was about a pint and a half of discharge each day. Diminished to 2 ounces during the next month. At the end of 5 months a slight discharge. Three years after the operation, the patient was in fair health	Radical cure	J. Russel, 'Dub. Journ. Med.,' Nov. 1837; 'Archives gén. de Méd.,' 1838, t. 1, p. 106; Davaine, obs. cclxxi, p. 578.
81	M. adult	Supposed abscess on the right side of the abdomen. Incision	Discharge of a great number of vesicles, it is assumed, with a yellowish fluid	The discharge of hydatid cysts continued for several days. The patient was perfectly cured	Cure	Rivière; Cruveilhier, 'Diction. de Méd. et de Chir. Prat.,' t. i, Art. "Acéphalocystes," p. 223.
82	M. adult	Tumour, right hypochondrium, increasing for 6 years, and causing much distress. It was taken for an abscess and incised	A great quantity of hydatids, accompanied by a thick viscid matter	More than 300 hydatids came away at different times. The patient was worn out, and died after a year. The great cyst in the liver was full of hydatids and a purulent fluid	Death	Camerarius; Cruveilhier, op. cit., p. 224; 'Boneti Sepulchretum,' p. 1532.

83	M. adult	Tumour in the hepatic region mistaken for an abscess, opened by incision	Discharge of hydatids and fluid immediately, and for 5 days after	The patient grew weaker and weaker, and died on the 5th day	Death	Panaroli, obs. xvi, cit. par Lassus, 'Rech. et Obs. sur l'Hydropsie enkystées du Foie;' Davaine, obs. cclxxiv, p. 581; Cruveilhier, op. cit., p. 225.
84	M. adult	Tumour of the epigastrium taken for an abscess. Incision	About 2 pints of limpid serosity	Watery fluid continued to be discharged, and there was constant hiccup and vomiting, and death on the 3rd day	Death	Sue; Lassus, Mém. cit., obs. ix; Davaine, obs. cclxxvi, p. 581; Cruveilhier, op. cit., p. 225.
85	M. 62	An enormous hydatid cyst of the liver distending the right hypochondrium, opened by a bistoury	A great number of hydatids and much yellow purulent fluid discharged	The patient died three days after the operation	Death	Récamier; Briançon, 'Essai sur le Diagnostic et le Traitement des Acéphalocystes,' Thèse de Paris, 1828, p. 16; Davaine, obs. cclxxvii, p. 582.
86	F. 47	Fluid tumour of right hypochondrium opened by two incisions; the first down to the peritoneum; and 4 days after this, the second was carried through this membrane into the cyst. The wound was kept open by a tent, and detergent injections were thrown into the cyst	Much yellow fluid was evacuated	A sero-purulent fluid continued to be discharged; but fever ensued, and the patient died soon afterwards	Death	Rayer and Velpeau, 'Bull. gén. de Thérap.,' 1844, t. xxvi, p. 58; Davaine, obs. cclxxviii, p. 583.

No.	Sex and age.	Situation of the tumour and treatment.	Nature and quantity of fluid withdrawn at the operation.	Progress.	Result and remarks.	Reference to author.
87	M. 35	Large tumour of the liver pointing in the right hypochondrium. Incision, a tent placed in the wound, and removed each day	A sero-purulent inodorous liquid, and a great number of hydatids	The discharge became fœtid, and the cyst distended, on the 5th day, and the patient died on the 6th. There were 4 cysts in the liver, and the omentum was strewn with cysts from the size of a nut to that of a fist	Death. Long before the tumour was opened the patient had had several severe attacks of sharp pain	M. Pinault; Cruveilhier, op. cit., p. 226.
88	F. 29	A small tumour of the liver opened by incision, first down to the peritoneum, and three days after into the cyst. The wound kept open by a plug. The discharge of hydatids facilitated by traction with a forceps. Injection of marshmallow water from the 8th day	About a pint of clear citrine-coloured fluid at first, and about 6 ounces each day for the next 3 weeks	Day after the operation, fever, abdominal pain, and discharge of brownish fluid; afterwards, evacuation of hydatid cysts and bilious yellow fluid. Retraction of the tumour, and after six weeks the patient was progressing towards cure	Cure	Jarjavay, 'Gaz. des Hôpitaux,' 1850, No. 89, p. 353, and No. 100, p. 397; Davaine, op cit., obs. cclxxix, p. 583.
89	M. 33	Tense tumour of epigastrium and right hypochondrium. Application of caustic potash below	A pint of limpid fluid	Progressed well for a month; the sac discharging fluid and cyst-wall, and contracting. Then	Radical cure	M. Récamier; Debouis, Thèse de Paris, 1828, No. 263.; Barrier, Thèse cit., p. 81; Cruveilhier,

		the ensiform cartilage; incision through the eschar, and injection of emollient fluid. After a month, enlargement of the wound		arrest of discharge, great abdominal pain, tympanitis, increase of the tumour, and dyspnœa. After the wound was enlarged, an issue of a great quantity of fœtid pus, and a little sero-pus. Great relief; and two days after, discharge of cyst-wall, and increase in the flow of yellow-coloured fluid. Uninterrupted progress, and at the end of 11 months the cyst was contracted to the capacity of an ounce. Discharged cured 5 days afterwards		Art. "Acéphalocystes," p. 236 (?); Davaine, obs. cclxxxi, p. 586.
90	M. 18	Considerable tumour of the epigastrium and right hypochondrium. After an exploratory puncture, an incision. Injection of water and alcohol into the cyst, and retention of an elastic catheter	Discharge of serous fluid, and a considerable quantity of hydatids	At the end of 2 months, 60 to 80 minute hydatids were discharged at each dressing, and the patient was going on well	Cure. The liver was incised to the depth of from 1 to 1½ in., in order to reach the cyst	M. Jobert, 'Gaz. des Hôpitaux,' Août, 1833, p. 383; Davaine, obs. cclxxxii, p. 587.
		Another successful case of incision is recorded by—				E. Alexander, 'Boston Med. and Surg. Journ.,' vol. xviii, 1838.

TABLE V.—*Cases in which the tumour was opened wholly by caustic potash, or by spontaneous rupture.*

No.	Sex and age.	Situation of the tumour and treatment.	Nature and quantity of fluid withdrawn at the operation.	Progress.	Result and remarks.	Reference to author.
91	F. 40	Enormous hydatid cyst of the right lobe of the liver. After seven applications of Vienna paste upon the centre of the right hypochondrium, the cyst gave way on the 7th day	Issue of 5 pints of puriform fluid and hydatids	Rapid amelioration; discharge through the fistulous opening for 5 months, and completion of the cure	Radical cure	Adolphe Richard, 'Bull. gén. de Thérap.,' 1855, t. xlviii, p. 414; Davaine, op. cit., obs. ccxcvii, p. 606; 'Med.-Chir. Rev.,' 1856.
92	M. 20	Painful tumour of the right hypochondrium. Two applications of caustic potash to the most prominent part of tumour, and spontaneous opening of the cyst. Emollient injection to prevent entrance of air	Issue of 10½ pints of yellowish limpid fluid, with hydatids of every size	No bad symptoms; discharge of hydatids and fœtid fluid continued, and in 3 weeks' time the sac had contracted to the capacity of 4 ounces; but it subsequently became distended with matter resembling that contained in the end of the small intestine, and fragments	Radical cure	Récamier, 'Clin. Méd. de l'Hôtel-Dieu de Paris,' 1827; 'Lancet,' 1833, vol. i, p. 739; L. Martinet, "Obs. d'un Kyste hydat. du Foie," 'Revue Médicale,' t. iii, p. 436 1827; Barrier, Thèse cit., p. 58; Cruveilhier, op. cit., Art. "Acéphalocystes," p. 231; Duputyren, 'Journ. Hebd.

				of the food were observed in the discharge. These soon ceased to pass, and the patient went out of hospital in about 10 weeks from the opening of the cyst, with only a slight fistulous orifice		de Méd. et Chir.,' t. iii, p. 390; Davaine, op. cit., cclxxx, p. 585.
93	F. 20	Large tumour of right hypochondrium, causing tension and ulceration of the abdominal walls	Discharge of clear fluid and hydatids	Recovery	Recovery	F. Plater, 'Observat. selectæ,' obs. xviii, p. 44; cité par Cruveilhier, Art. "Acéphalocystes," p. 223; Davaine, obs. cxlv, p. 508.
94	M. 34	Tumour of right hypochondrium, diagnosis confirmed by exploratory puncture. Application of caustic potash, after which Canquoin's paste (chloride of zinc) for 9 days successively, until the cyst was opened	9 pints of yellow fluid	After rupture of the cyst and evacuation of its contents, the discharge was arrested to prevent hæmorrhage into the cyst. This, however, occurred on the 3rd day, and the patient sank on the 4th day, after the cyst was opened	Death. No hooklets could be found in the discharge before death, or in the body at the post-mortem examination	M. Gayet, 'Gaz. Méd. de Lyon,' 15 Mai, 1865; 'Brit. Med. Journ.,' vol. i, 1865, p. 650.
95	F. 50	Fluctuating tumour in the hepatic region; reddening of the integuments, and spontaneous rupture at the umbilicus	Discharge of liquid pus and a great number of hydatids	The discharge continued a month, and death then took place from exhaustion	Death	Frerichs, 'Dis. Liver,' Syd. Soc. Ed., vol. ii, p. 237.

No.	Sex and age.	Situation of the tumour and treatment.	Nature and quantity of fluid withdrawn at the operation.	Progress.	Result and remarks.	Reference to author.
96	F. 42	An hydatid tumour burst through the umbilicus and discharged— 3 years afterwards, the epigastric and right hypochondriac regions again swelled and became painful. The tumour was incised at a red prominent point in the hypochondrium	A pailful of a peculiar gelatinous matter Issue of blood and pus	Sanious matter and cyst-wall continued to be discharged, and a fistulous opening remained for nearly three years. 17 years after the spontaneous rupture of the cyst she came under notice, when both apertures were found open and the surrounding parts slightly retracted to them. The whole of the proper substance of the right lobe of the liver was converted into a thick cartilaginous mass partially ossified, and imbedded therein was a large cyst containing a pint and a half of fluid and hydatids of various sizes	Spontaneous rupture of the cyst, and subsequent puncture ineffectual for destroying the animal. The patient died of albuminuria and uræmia	J. W. Griffiths, M.D., F.L.S., 'Lond. Med. Gaz.,' vol. xxxiv, p. 585, 1844.
97	F. adult	Large hydatid tumour of liver bursting through the abdominal walls immediately below the umbilicus	Enormous discharge of fluid, and subsequent evacuation of an hydatid cyst capable of holding 12	Exhaustion and death in about 4 days. The large cyst was situated on the under surface of the liver, where was found a	Death	Dr. Bright, 'Mem. Abd. Tumours,' Syd. Soc., p. 19; 'Guy's Hosp. Rep.,' vol. ii.

				pints; then serous fluid and blood	cavity lined with false membrane and filled with grumous blood derived from the mouth of an hepatic vein		
	98	M. 40	Tense, circumscribed tumour of right hypochondrium. Nine months after, fluctuation, reddening of skin, and spontaneous rupture	More than 300 entire hydatids	The wound remained fistulous for a long time, but the patient was not inconvenienced by it. It was healed six years afterwards.	Cure	Guattani, 'De Ext. Aneur.,' p. 109, Romæ, 1772; Cruveilhier, 'Dic. de Méd. et de Chir. prat.,' t. i, Art. "Aceph.," p. 223.
	99	F. 53	Hydatid tumour of the liver for 30 years. Spontaneous rupture near the umbilicus 29 years before death	"A particular liquid which occasionally presented a purulent character"	At the time of rupture a great number of hydatids were discharged through the opening, and this recurred from time to time. Two tumours were found near the umbilicus which communicated with a passage full of a chalky matter, continuous with the upper part of the liver	The evacuation of the contents of the tumour failed to arrest the growth of the parasite; but it appears that the tumour in the liver underwent calcareous degeneration and contraction	Thompson; 'Gaz. Méd. Paris,' 1844; Cadet de Gassicourt, Thèse de Paris, 1856, No. 50; Davaine, obs. v, p. 384.
	100	—	Hydatid tumour of liver, rupture through abdominal parietes	—	Infiltration of hydatid fluid under the skin and abdominal muscles, causing sloughing and—	Death	G. Budd, M.D., and Sir W. Fergusson; Budd on 'Dis. Liver,' 3rd edition, p. 437.

1. Harewood Place,
Hanover Square.
W.

April 14. 1879.

Dear Dr Harley

Let me thank you for
your interesting Essay on the Structure
& Hydatid Disease of the liver — I shall
I guide myself by it.

Very truly yours

James Paget.

origin. Has hydatid disease therefore increased in this country? I think not; believing that an explanation may be

23 March 1879

My dear Dr Stanley.

Your Paper on Hydatid Disease of the Liver is a very valuable one.

I have been gradually becoming more & more disgusted with the results of aspiration in this affection. (Our last case died at once from chloroform shock 2 months ago.)

I think You are right as to a radical plan of cure. Look in Prof. Bennett's last Edtn of his Princip. & Pract of Physic, & You will find (1865)

origin. Has hydatid disease therefore increased in this country? I think not; believing that an explanation may be

a very good case in which
I made the diagnosis for him,
(he had never seen a case) &
in wh. I operated with a Larg
trocar after attempting to pe-
aspirate by retropharyngeal. (18
The man recovered &
the whole cyst-lining came away
I have had another one in
a young woman which did
well in the same way, a

large indian rubber tube being
left in permanently, & the cavity
being washed out with disinfectants.

Perfect recovery certified for
some years afterwards.

I shall adopt your practice
in future, & have no more
aspirations. You shall hear of
my results.

Yours always
Dyce Duckworth

origin. Has hydatid disease therefore increased in this country? I think not; believing that an explanation may be

Dear Dr. Hartley

Many thanks for the
copies of your papers, which I
have glanced at in the
St. Thomas Rep.s in Chemistry, & am
glad I hope only to study
them subsequently at my leisure
in reference to hydatids

Sincerely yrs
C. Theodore Fagge.

March 73.

origin. Has hydatid disease therefore increased in this country? I think not; believing that an explanation may be

10. Grosvenor Street.
Grosvenor Square. W.

March 22 79

Dear Dr. Hurley

Many thanks for your
offer re the treatment
of hydatid disease of
the liver — full
of information and suggestion
of which I shall avail myself
soon.

Always faithfully yours

Hermann Weber

my paper, and the greatest number of these 72 have occurred in Britain, and may in the main be regarded as of indigenous origin. Has hydatid disease therefore increased in this country? I think not; believing that an explanation may be

Dr. med. J. Jónassen
Reykjavik 19-10-87.

Sir!

Please accept my best thanks for your pamphlet on the treatment of hydatid disease of the liver. I have read it with great pleasure and interest although I may differ in some points, especially as regards the treatment with caustic potash, which in my hands never has failed to effect adhesion. According to my great experience it is too hard words, when you say, that this method is "a clumsy and painful procedure, which should be forever abolished from scientific medicine. „Facta loquuntur"

Dear Sir! Believe me remain
very truly yours
J. Jónassen

my paper, and the greatest number of these 72 have occurred in Britain, and may in the main be regarded as of indigenous origin. Has hydatid disease therefore increased in this country? I think not; believing that an explanation may be

TREATMENT OF HYDATID DISEASE OF THE LIVER.

By J. HARLEY, M.D. Lond., &c.

The origin and spread of echinococcus disease in man and the domestic animals is an enquiry which might employ the abilities of a Hunter, and satisfy the philanthropy of a Howard. It flourishes from pole to pole, and no sooner is our attention directed to its ravages in Iceland, than we are called to witness its equally extensive developement in Australia. Probably no intermediate country is free, for the Tænia echinococcus, like man and his chief brute campanions, is ubiquitous; and one fact in the history of the disease may be taken as proven, viz. where dogs abound, there echinococcus disease is plentiful. Twelve years ago I gleaned from the medical literature of Germany, France, and England, and almost to the complete exclusion of the countries above mentioned, one hundred cases of the disease which had come under treatment during the previous twenty years or so. On the present occasion I am able to present a synoptical view of 96 more, all of which except a few of Mr. Mac Gillivray's cases have come under notice since I published my paper, and the greatest number of these 72 have occurred in Britain, and may in the main be regarded as of indigenous origin. Has hydatid disease therefore increased in this country? I think not; believing that an explanation may be

found in the fact that the disease is more readily diagnosed, and more frequently treated and recorded than formerly.

Hydatid disease of the liver is a formidable affection. It is easy of diagnosis, but its treatment requires uncommon care and vigilance, if that treatment, as I think it should, be directed to its radical cure.

As I am able to furnish a few good illustrative cases, I am encouraged to hope that these, and a review of the tabulated cases, will be of real help to those who may be called upon to treat the subjects of this disease. I shall apply my remarks to the elucidation of the following :—

1. The propriety of using means to promote adhesion of the outer surface of the cyst, or of the liver containing it, to the abdominal walls—in a word, adhesion of the visceral and parietal layers of the peritoneum, in order to prevent the escape of hydatid fluid into the peritoneal cavity when the cyst is opened.

2. The effect of simple puncture of the cyst, and its influence on the further development of the disease.

3. The use of the aspirator.

4. The electrolytic mode of treatment.

5. Treatment by acupuncture.

6, and lastly. The treatment for effecting a radical cure.

1st. As to promoting adhesion of the peritoneal surfaces. The repeated application of caustic (caustic potash, Vienna paste (Potassa cum Calce) or chloride of zinc), to the skin and subjacent tissue until the peritoneum is involved in inflammatory action, is the means employed. Nos. 19, 32, 46, 50, 56, 63, 64, 66, 69, 70, 71, 72, 73, 74, 76, 89, 91, 92, and 94, of my tables, vol xlix of the 'Medico-Chirurgical Transactions,' and Nos. 55, 79, 84, 89, of the present papers illustrate this practice. It will be seen, however, that in only six of these was the cyst opened by the action of the caustic. In the remainder the eschar was either punctured by a trocar or incised, on the assumption probably that the required adhesion had been effected. Of this, however, there is no evidence; on the contrary, from the general absence of signs of local peritonitis, and from the post-mortem examination in Case 73, in which three applications of caustic failed to effect adhesion, it might be inferred that this did not occur.

I have myself witnessed an extensive destruction of the skin

and subcutaneous tissue without an approach to the desired result. On account of its inefficiency alone, such a clumsy and painful procedure should be for ever abolished from scientific medicine.

Experience, however, has shown, on the one hand, that previous adhesion of the peritoneal surfaces is not a necessary antecedent to the successful treatment of these tumours; and on the other, that the readiest way of promoting adhesion is to puncture the tumour with a hollow needle or a trocar of a size insufficient to relieve the distension of the cyst, when on its withdrawal the escape of a few drops of the liquid contents will usually occur, and set up a slight local peritonitis[1] and subsequent adhesion of the cyst to the abdominal wall. When a large trocar is used, and the distension relieved, either no adhesion is required, as there will usually be no escape of cyst contents, or if the latter event should occur from rapid refilling of the cyst, adhesion will be readily affected, as in the former case. Death from peritonitis arising from overflow of cyst fluid after puncture with a trocar is a rare event. It occurred in cases 5, 34, 38, 42, and 89; and in three of these cases it followed simple puncture. In the treatment of hydatid tumours of the liver, for radical cure we may therefore, I believe, disregard all question as to whether or not the cyst, or the peritoneal surface of the liver containing it, be adherent to the abdominal wall.

2nd. The next questions which I shall endeavour to answer are (*a*) the effect of simple puncture on the contents of the cyst, and (*b*) its influence on the further development of the disease.

The fluid withdrawn from every normal hydatid tumour of

[1] Clear hydatid fluid, apart from the larvæ of the animal, is regarded by some as innocuous. The fact that it is "chemically inert" proves nothing, the most virulent animal poisons are so. That the rupture of a hydatid tumour into the peritoneum does not always prove fatal, but sometimes causes only ascites, is rather a proof of irritation than the contrary. In the treatment by electrolysis, Dr. Fagge and Mr. Durham noted fluid effusion into the pleura in one case and into the peritoneum in three. The authors attribute it wholly to escape of fluid from the cyst during and after the operation. This assumes too much, for it is apparent that considerable irritation attended the process, and it is probable that some portion of the fluid was passed out by the serous membrane under the influence of irritation, partly by the galvanic needles, and partly from the escape of hydatid fluid. (See p. 8.)

the liver is limpid, colourless, transparent, odourless, and of sp. gr. rarely exceeding 1012. When solid particles are found they are either scolices or the granules associated with them.

On a second tapping, after a short or longer interval, the character of the fluid will be found almost always changed. It will be more or less turbid, considerably denser, and of a more or less decidedly bilious tinge (ochre coloured or greenish) and odour. This happens when inflammatory action has been entirely absent. If the cannula be kept in the cyst, after either the first or second tapping, it commonly happens that the dressings and bed clothes are saturated the next day and for some time after with a brilliant grass-green or gamboge coloured discharge,[1] and yet as far as its attachment to the liver is concerned the parent sac is as yet intact. This ready escape of bile into the parent cyst after tapping is an important event, and one which, so far as I know, has received very little attention either as to its cause or effects. The influx of bile is clearly due to rapid endosmosis through the parent cyst, and begins as soon as the tension[2] is relieved to any extent, or abolished by the withdrawal of fluid.

The effects of this influx of bile into the hydatid cyst is as I have said an important event. If the cyst open externally by a free passage, no harm whatever results, but the case is different if the sac be closed, or if the passage out of it be obstructed. In the first case, and when by the removal of a little fluid the tension is only diminished, the escape of bile is small in amount, and does little if any harm, but when a larger quantity transudes the sac it is apt to decompose, and the danger is in proportion to the capacity of the cyst and the quantity of fluid withdrawn.

The admission of bile and its decomposition within the sac is the first element of danger in the treatment of hydatid tumours of the liver. Its presence is a necessary result of tapping, and

[1] This is, of course, to be distinguished from the copious discharge of pure ropy bile which often occurs at a later stage, when the parent cyst has separated partially or wholly from the liver and left the open orifices of bile-ducts on the raw surface of the gland; the hydatid cyst, indeed, is very often in its origin a mere diverticulum of a bile-duct.

[2] The tension of hydatid cysts is one of their characteristic features. Dr. Stone measured that of Case 2 of this paper and found it to be between eleven and twelve inches of water.

its probable decomposition within the sac is an event which should be expected, in order that it might be met with prompt treatment. The rapid refilling of tumours after simple puncture and the febrile symptoms which often ensue are I believe mainly attributable to this cause.

It would appear then that the effect of simple puncture is, if only a small quantity of fluid be withdrawn, to leave the cyst and its contents unchanged; or, when its tension is sufficiently reduced, to cause the whole to be permeated by bile. We have now to enquire (*b*) what influence this has on the further developement of the disease. Pure bile, or bile diluted with hydatid fluid, has no deleterious effect on the growth of the parasite. The parasite will flourish in either, and so long as the contents of the cyst remain sweet, its growth may and usually does continue. But the case is different when decomposition of the fluid takes place, then the parasite, it would appear, is destroyed and the hydatid cyst is converted into a reservoir of unwholesome or even putrid fluid, the lining membrane is is hardened, the daughter-cysts become disintegrated, fatty matters and sometimes pigment are deposited from the bile, and a chronic tumour results, liable on depression of the health to increase by further accumulation of fluid.

If we now turn to the synoptical tables I and III, accompanying this paper, it will be seen that simple puncture was employed in 77 cases. In 30 of these (20 of Table III in which it was first of all employed; and the 10 fatal cases of Table I) it was wholly unsuccessful. Many of the cases in Table I are said to have been cured. I am sorry to say it, but neither reason nor experience allows me to assent to this conclusion. 13 at least were too short a time under observation to allow more to be said than that they were relieved. Besides these I have included 11 others in this category, and this is as much as the accounts of them warrant. There were 10 deaths. The remaining 23 cases I have classed as "recoveries," for I hold that the simple tapping of a hydatid cyst cannot result in absolute cure unless the cyst not only collapses, but becomes wholly absorbed. What evidence have we that this ever occurs? It will be said "the tumour can no longer be detected." I do not attach much value to such a statement. I have purposely given an account of a case (see Case 6, p. 35)

to show that the parasite is not easily dislodged, and that there is a tendency to the redevelopment of the tumour after a period of apparent cure. Both Case 1, p. 16, and Case 2, p. 19, are also capital illustrations of this. In one the tumour persists, and living echinococci are found freely developing, while the daughter cysts are floating in "laudable" pus after an interval of 5 years: in the other after an equally long period of quiescence, a slight indefined fulness expands all at once into a tumour of its original dimensions, and its treatment leads to the suppuration of another cyst on the other side of the liver, which it was previously impossible to detect by percussion, palpation, measurements, or any other means at our disposal. Hence I am careful how I deduce a "cure" from the statement that no trace of the tumour was detectable, especially when this statement is made a few weeks or months or even two or three years after treatment.

I have known a patient, stated to be cured of the disease, present himself ten years afterwards with a full redevelopment of it. A long interval of time or a post-mortem examination, therefore, would alone satisfy me. Post-mortem examinations of those who have died of another disease some time after tapping of the cyst have not proved much in favour of absolute cure. I have only met with two such records.

1. Dr. H. L. Atkinson tapped a hydatid cyst with a small trocar; the man made a good recovery, but he was subsequently admitted into and died in the hospital, and a contracted hydatid cyst containing putty-like material which probably consisted of the daughter-cysts undergoing calcification and disintegration was found remaining. ('Australian Med. Jour.,' vol. xii, p. 289.)

2. A similar case recorded briefly by Mr. Hulke.

3rd. *The use of the aspirator.* The insertion of hollow needles into the cyst and suction by the aspirator has been used (see tabulated Cases 2, 3, 9, 11, 24, 44, 71, 73, 75, 81, 90, 94,) instead of puncture by a capillary trocar. It has this advantage over the latter, that when a minute hydatid cyst or fragment of membrane obstructs the capillary tube it may sometimes be drawn away and the flow re-established; but it is time enough to apply the aspirator when the obstruction happens. The hollow needle is only applicable for a first puncture; when the cyst is full of broken-down membrane and grumous fluid, it is

obviously useless. But the aspirator may be sometimes connected with a large cannula or catheter in the process of radical cure, to facilitate the discharge of such fragments as will pass through the instrument inserted in the sac; but even in these cases its use is extremely limited (see Case 2, p. 29). We may, however, meet with cases in which the hydatid *débris* is fine enough to pass the needles. A case (tabulated cases 24, p. 44) in which 8½ pints of pus and hydatid *débris* were easily removed by the aspirator, has induced my friend Dr. Bradbury to remark, "Formerly I should in a case of *suppurating* hydatid cyst have recommended the insertion of a large trocar and a drainage tube; more extended experience, however, has taught me that it is much better to use the aspirator, and if one aspiration be not sufficient there is not the least objection to the operation being several times repeated."

Further experience of the use of the aspirator in this disease will I feel sure give no support to this view. Even when a wide tube is inserted in the sac, the exhausting syringe is a frail support to lean upon, and if I had trusted to it in Case 2, my patient would probably have been now in his grave.

Where there is no obstruction to the flow, as in a normal cyst, aspiration may do harm by causing too rapid a removal of the tension to which the surrounding parenchymatous parts have accommodated themselves. This was doubtless the case in 44.

4th. *The Electrolytic Treatment of Hydatid Tumours of the Liver.* This mode was suggested by Dr. Althaus, who used it on a horse. Since the publication of his recommendation the animal has died, and a careful examination proved, as my friend Mr. Mavor tells me, a great extension of the original tumour. The operation does not appear, therefore, to fulfil its primary object, viz. the death of the parasite.

Dr. C. H. Fagge and Mr. Durham, and also Dr. Handfield Jones,[1] have used this method. It consists in attaching two needles to the negative pole of a battery of ten cells, producing a current strong enough to decompose a saline solution; inserting these into the cyst at a distance of about two inches apart; a moist sponge in connection with the positive electrode being placed on the skin near the needles.

[1] An abstract of the cases is given in Table II, p. 53.

The current was allowed to pass from ten to twenty-five minutes, when the needles were gently withdrawn, and the punctures covered with plaster. In two or three instances one or two drops of clear fluid followed the withdrawal of the needles, and in one case the skin around the needle became emphysematous (from decomposition of water) during the passage of the current, which always caused at once enough irritation of the tissues to produce distinct redness around the needles.

In some of these cases it appeared that a part of the contents of the cyst escaped about the time of the operation or shortly after. In Case 2 effusion into the pleura was discovered on the second day after the operation, and although the measurement did not indicate it, the bulging of the chest appeared to be greatly diminished. In Case 3 the cysts felt more flaccid and less defined on the fifth day after the operation, and there was a diminution of half an inch in the girth at one line. In Case 4, where there was assumed to be peritoneal effusion on the day following the operation, no mention is made of the tumour until the thirteenth day, when it was "softer, but perhaps not smaller." In Case 5 the left cyst was found to be much softer, and could not be distinctly felt directly after the operation. One of the authors thought this was due to rupture from much vomiting. Next day there was distinct fluctuation in the lower part of the abdomen (presumed to be in the peritoneal cavity). The right cyst was more tense immediately after the operation, but about an hour after, the patient having been sick in the interval, fluctuation in the abdomen was distinctly felt, and the cyst was softer. In Case 6 the tumour had decreased in size, and was no longer elastic on the fourth day. In Case 7, without previous vomiting or retching, the abdomen was already flaccid, and the fingers could now be passed under the edges of the ribs. There was no sign of peritoneal effusion, and the measurement of the body next day showed a decrease of an inch and a quarter.

The authors regard the rapid decrease of tension in the cyst and appearance of fluid in a neighbouring serous cavity as cause and effect. Even in Case 2 they think it "hardly possible that pleurisy set up at a single spot could have given rise to the exudation of so large an amount of fluid within forty-eight hours, and particularly without the patient suffering

from more severe symptoms" than pain in the chest and at the points of introduction of the needles, a pulse ranging from 88 to 104, and temperature from 99·6° to 101·2° Fahr., and they conclude that the fluid was derived (in great part at least) from the hydatid cyst through a wound in the diaphragm made by the needles. I cannot concur in this view. According to my experience a large amount of pleuritic effusion not unseldom forms with equal rapidity, and very often with less pyrexia, and absolutely no pain. I take the effusion in this case to be entirely due to direct irritation of the pleura, and if this be the correct view then it follows that some peritonitis is to be expected in an ordinary case. Such results of the application of electrolysis, viz. pleural and peritoneal effusion, prove that this mode of treatment, if it do not introduce a fresh danger, at least increases that which already attends the treatment of this disease.

But granting that some of the fluid is the result of direct irritation of the serous membrane, the observations of Dr. Fagge and Mr. Durham undoubtedly show that part of it may be derived from overflow of the hydatid cyst. The elasticity of the sac is, no doubt, destroyed at the seat of puncture; and the current being strong enough to decompose water hydrogen is liberated. It is therefore reasonable to suppose that in a cyst already tense with fluid, a portion of this would necessarily be displaced. When the sac is not punctured at its most prominent part, the hydrogen would produce corresponding resonance, as occurs when gas is liberated by putrid decomposition within it (see Case 2, pp. 27, 28). The quantity of hydrogen evolved, though sufficient to increase the tension of the cyst would, however, be generally too small to be detected by percussion.

Taken as an accepted result of the use of electrolysis the escape of fluid from the sac deserves careful consideration. As yet we have no positive evidence that the current used as above described can destroy the life of the parasite. Dr. Althaus used it much more thoroughly in the horse, yet this result was not achieved. If suppuration of the cyst may occur without destruction of the parasite (see Case 1, p. 17), we may certainly conclude that electrolytic decomposition of a minute portion of the contents of the cyst is totally inadequate to effect it.

It must be concluded, then, from the evidence before us that

the electrolytic treatment causes an overflow into the serous cavity enclosing the tumour of such unaltered constituents of the hydatid cyst as will pass through the puncture made by the needles, and that this may contain living scolices.

This conclusion obviously brings with it a complete condemnation of this method of treatment. But what of the results? Eight patients have been treated by the method. All recovered. In all but two, however, some remains of the tumour were found on the last examination, and in two the liver was still low down. Case 3 came under treatment again in the course of a year. The assumption of the existence of a third cyst in this case is quite gratuitous; where was the position which was different from that of either of those previously operated on? of those which reached from the left nipple to midway between the ensiform cartilage and umbilicus on one hand, and from the margin of the ribs on the right side to the crest of the ileum? As a difference of opinion might clearly arise on such a point it would have been well if Dr. Phillips had stated the position of the third cyst. The actual seat of a hydatid cyst of the liver is not always what it seems; tumours which appear in the left hypochondrium are sometimes, not unseldom I believe, found to arise far away in the right lobe of the liver (see tabulated cases.) This fact should not be overlooked in deciding the true position of a hydatid cyst.

Speaking generally of the results of treatment in these cases, it probably agrees pretty closely with that by simple puncture. It is very doubtful whether a radical cure was effected in any case; time and the opportunities of post-mortem examinations can alone decide the question.

5. *Treatment by Acupuncture.*—Thinking that the escape of hydatid fluid from the cyst into the peritoneal or pleural cavity was, perhaps, an essential element in the success of the operations of electric puncture, Dr. Fagge and Mr. Durham suggest that electrolysis may be in effect a kind of subcutaneous tapping with effusion of the fluid contents of the cyst into a serous cavity.

They tested the practical value of this suggestion, and induced Dr. Playfair to introduce two gilt needles into the interior of a hydatid tumour of the liver at its most prominent points. After five minutes they were withdrawn. Some pyrexia followed

and continued for a few days. When last seen (two months after the operation) the tumour was reduced to half its previous size ('Med.-Chir. Trans.,' vol. liv, p. 43).

The rise of temperature which began soon after the operation, and in twenty-four hours attained 102° Fahr., could not have been due to the presence of bile (see p. 4). We must therefore regard it as the result of peritoneal irritation, and, so far as it goes, a practical illustration of the view that the escape of normal hydatid fluid excites peritonitis (see p. 3).

I now come to speak of—

6. *The Treatment for Radical Cure.*—When we cannot cure, we properly seek to relieve; but if it be within our power to cure, then it is unworthy of the objects of our profession to endeavour merely to relieve, provided that cure can be effected without undue risk.

I have been at great trouble to glean and summarise all the published records of the cases of hydatid tumour of the liver. They are contained in vol. xlix of the 'Medico-Chirurgical Transactions' and in the tables appended to this paper.

A critical survey of these cases, coupled with a due consideration of the fact that radical cure cannot be effected by any means which do not secure the discharge of the parent cyst, and gradual healing of the cavity occupied by it, will I believe lead a careful medical practitioner to at once adopt treatment for the attainment of this object.

Puncture with a fine trocar or aspirator needle, and the letting out of a few ounces of fluid, is, *primâ facie*, a satisfactory proceeding. It is easily done, it demonstrates to a nicety the accuracy of diagnosis, is often unattended, just as puncture with a large trocar is, by any disturbance, and seems, in many cases, to effect a cure. The cure, however, is but seeming, and in the main the treatment is at best but a postponement of the evil day. It is far otherwise when a large cannula is inserted and retained. The operation itself is certainly attended by pain and febrile disturbance less frequently than simple puncture with a capillary trocar; but the utmost vigilance is required to secure the discharge of hydatid membranes and to prevent them from greatly impeding or altogether preventing the discharge of readily decomposable bilious fluid (see p. 4), the retention of which for forty-eight

hours will certainly be followed by pyrexia, and very soon become a source of danger.

A clear conception of the nature and requirements of the case, and vigilant and patient care, will, I believe, very rarely if ever, fail to secure the desired result.

I shall be pardoned, I trust, if I occcpy a little space iu pointing out the nature and requirements of the case a little more explicitly, in illustration of a mode of treatment which has other advocates besides myself—notably MM. Demarquay Paul, and Verneuil and Dr. Finsen, of Copenhagen.

To put a large cannula into a hydatid cyst and retain it there is undoubtedly a serious matter, unless we are alive to the necessity of carefully preventing impediment to the discharge of readily decomposable fluid which rapidly strains into the cyst. The secondary cysts entire, or the fragments of membrane resulting from their disintegration; and later on the wall of the parent cyst itself, and sometimes a dense fibrous membrane which is formed external to this, are the hindrances to be got rid of by patient and long-continued efforts day by day. A reference to pp. 18, 23, and 29, will show the means employed. As soon as the cannula becomes loose by suppuration, and this occurs at the end of seven or nine days, as large an elastic catheter as will pass is inserted, and the cannula slipped over it and withdrawn. Next day a second catheter, a No. 2 or 3, may be readily passed by the side of the former, and now that two are inserted the one becomes a guide to the other and we never lose the way into the sac. After an interval of a few days No. 2 may be replaced by No. 5 or 6, and even we may be able to change the larger one, No 9, say for No. 11 or 12; in the course of a day or two we may pass in the groove between them a No. 2 or 3, and so we proceed until three catheters of full size are inserted into the sac, the depth of which must be carefully gauged, and a little room given for the gradual contraction of the sac.

While the cannula is retained we must "fish" for the obstructing membranes around the internal orifice of the tube and try to hook them away. When the catheters are inserted and the passage dilated, we may inject a few ounces of fluid, preventing its return, and then on suddenly withdrawing two of the three catheters, we may—and especially if the movement

be accompanied by a succession of little coughs—get a gush of fluid with the obstructing fragments of membrane. Frequently, indeed, we shall not succeed in this, but as often as we remove a catheter we shall find the eye blocked with membrane. If there be no urgency we may depend on this method of removal, until the way into the sac becomes sufficiently wide and direct to allow of the simultaneous removal of all the catheters, when if there be only moderate distension of the sac the forcible eruption of a heap of broken membranes may be expected. Sooner or later the whole contents of the cyst, including the original wall, will be thus extruded, and we shall be gratified to find day after day that what we inject by one catheter immediately returns by the other, and that we can soon cause a current of pure injecting fluid to circulate through the sac. Contraction of the cyst now takes place very rapidly, the discharge becomes odourless and entirely purulent. Only one catheter is now needed, and, no force or resistance, of course, being employed, it is gradually forced out of the sac and lastly out of the sinus.

It often happens after a free discharge of membranes, and long before the whole of the contents of the cyst have been discharged, that the injection freely circulates through the sac, flowing out as fast as it is injected, and then, next day it may be, there is an impediment. This results from the gradual separation of the parent cyst, which we recognise by its size and thickness; and we infer that it has been wholly ejected by the absence of further impediment, and the character of the discharge, which will be simply pus of good quality.

While we are endeavouring to clear away the cyst membranes, we must keep the contents of the cyst as sweet as possible, and hasten, if we can, the disintegration of the cyst membranes. I have freely used iodine injection (water rendered a sherry colour by the addition of the tincture) with a little kreasote or carbolic acid (♏ij ad ℥j) for this double purpose. I am not sure that softening of the membranes is effected by the iodine, but we may certainly harden them by using too strong a solution of carbolic acid, one of sulphate of zinc, or some other astringent, and this must be carefully avoided. When the cyst is completely empty, I have sometimes washed it out with zinc lotion; but if the discharge be healthy pus, this is not needed, and

always maintaining a free outlet, it is best to leave the healing cyst alone.

It may seem to those unacquainted with this mode of treatment that it is painful and harassing to the patient. This is not really so, and pain and distress are alone experienced when the discharge from the cyst is impeded, or retained. When the contents of the sac are freely discharged there is no distress, and scarcely any discomfort, throughout. In injecting the cyst, great care must be taken to avoid undue distension, and the feelings of the patient, which we should carefully regard in this matter, will be a sufficient guide. If there have been no discharge for some hours, and a feeling of fulness in the cyst, we must not inject, but patiently remove the obstructing membranes, and then if fluid be discharged we may throw in a little disinfectant or wash out the cyst according to circumstances.

Table III, p. 56 *et seq.*, which contains an abstract of cases in which an effort was made, sooner or later, to evacuate the contents of the cyst, is pregnant with instruction.

Of the 31 cases there were 18 radical cures the result of operation; 2 radical cures by evacuation of the contents of the cyst through the lung, aided probably by a previous attempt to maintain an external opening; two (88 and 90) doubtful results; and 9 deaths.

The cases of radical cure are not all above criticism. Nos. 68, 73, 74, 79, 80, and 85, may be so regarded, for they serve to illustrate the great advantages that result from prompt treatment, and the formation of an opening sufficiently large for the discharge of the contents of the cyst.

Nos. 69, 70, 72, 75, 76, 77, and 84, on the other hand, prove the danger which threatened from retention of the discharge, but which was happily averted by making an opening into the cyst, or enlarging that already formed, and removing obstruction.

Case 82 illustrates in the treatment of both cysts the advantages of a free opening, and in the suppuration of one the danger resulting from putrid fluid pent up in a distended cyst.

But it is the fatal cases which require, and will well repay, a critical examination.

Cases 1, 32, 56, 57, 87, and the remaining ones to the end of the table form an interesting series, for they serve to illustrate

an important fact in the treatment of hydatid tumours of the liver, viz. that if retention of the contents after puncture of the cyst be permitted there is great liability to spontaneous rupture into a neighbouring cavity or gland. The fluid rarely escapes into the peritoneum to any extent, as occurred in Cases 5 and 89; but local pain and tenderness often follow puncture, and this must be caused by a slight overflow, for the cyst itself is insensitive. If the cyst is connected with the larger biliary ducts, an effort will be made to discharge through their common opening into the duodenum, as happened in Case 95; but the most common event is adhesion of the base of the right lung and of the upper surface of the liver to either side of the diaphragm, perforation of the latter, and escape through the bronchial passages. The frequency with which this occurs as a consequence of puncture and the closure of the wound, or the insufficiency of the opening, is due to the admission of biliary fluid, and its results as described at p. 4, a danger to be anticipated and avoided.

The accident in all its phases is so fully illustrated in the cases, especially Nos. 56 and 91, that comments are unnecessary, and the conclusion to be derived from a consideration of the whole of the fatal cases is that, with the exercise of greater vigilance and a determination to secure the evacuation of the contents of the cyst, recovery, with radical cure, would have been a probable result in thirteen of the nineteen fatal cases. One thing is certain, that medical science cannot look with satisfaction on a case in which a post-mortem examination reveals a cyst full of putrid or inflammatory contents, pent up and ready to burst into neighbouring organs, and which might have been safely discharged through a suitable artificial opening. The foresight and decision required in the treatment of these tumours can only be obtained by experience of such a number of cases as will fall to the share of but a few of us. It was therefore desirable to bring together into one view the experience of others, and it was this which has induced me to undertake the task. The information to be thus obtained will, I believe, sustain the opinions which I have ventured to express, and which are often at variance with those of the authors who have furnished the materials for the compilation of my tables.

I have only only to add that I shall be pleased at any time to arrange a personal examination of the subjects of radical cure,

whose histories I now proceed to relate, with any one who may be interested in them.

CASE 1.—*Hydatid tumour of the liver; capillary puncture; temporary relief; persistence of the symptoms; second puncture with a large trocar about five years afterwards; discharge of echinococci and pure pus; complete evacuation contraction, and healing of the sac.*

Sarah R—, now D—, æt. 23, a healthy young woman of moderate development, applied to me at the end of September 1872, on account of an almost constant pain in the back, some distress after meals, and occasional vomiting, caused by a tumour deeply seated in the epigastrium. I am indebted to the courtesy of the Registrar of Guy's Hospital for the following history:

"In 1865 she began to experience pain in the back and side; a year afterwards she noticed that the right side was tender on pressure, and after a short time it appeared swollen.

"The swelling gradually increased until 24th April, 1867, when she was admitted into Guy's Hospital, under Dr. Wilks.

At this time there was a circumscribed tumour, about three inches in diameter, in the epigastrium, extending rather further to the right than to the left of the middle line. It was distinctly fluctuant, rather tender on pressure, and she felt a constant throbbing in it (pulsation of the abdominal aorta). The general health was very good.

April 25th.—The tumour was tapped by Mr. Durham with a fine trocar, and about eight ounces of clear fluid was drawn off. Towards the end the cyst was pressed and the fluid came out milky. The milkiness could be seen by the naked eye to be due to granules, which showed themselves to be groups of echinococci, some with heads retracted and some with heads protruded, some apparently degenerating. The fluid was clear, with white sediment, of sp. gr. 1011, contained (?) a trace of albumin and a large quantity of chlorides.

28th.—Slight tenderness where she was tapped. Pulse 88; tongue clean; appears in perfect health.

30th.—She was allowed to leave her bed, and eight days afterwards was discharged.

Dec. 1st, 1871.—Four years and seven months afterwards she was readmitted under Dr. Wilks, with a hard, nearly defined

swelling just below the cartilage of the right side over the liver. There was pain in the tumour going through to the back, but no tenderness on pressure. After the tapping the cyst never filled again, but has been getting smaller. The patient is in pretty good health, and only complains of pain in the tumour. Tincture of iodine was applied externally and the pain was relieved, and she went out of the hospital at the end of the week."

Ten months afterwards she applied to me at St. Thomas's Hospital. She stated that her symptoms had only been temporarily relieved, that she was conscious the tumour had undergone little or no diminution, that the pain had been constant and "wearing," with distress and occasional vomiting after food, and that she was very desirous of an operation for relief.

The tumour formed a uniform rotundity of slight elevation, the centre or hydatid part being midway between the tip of the ensiform cartilage and the umbilicus. The lower limit of the tumour lay about one inch above tbe umbilicus, and the upper an inch and a half below the ensiform cartilage. The tumour was dull, tense, obscurely fluctuant, and free from tenderness, but firm pressure upon the front increased the pain in the corresponding part of the back. There were three quarters of an inch of fat on the abdomen.

She was admitted into Alice ward (No. 12 bed) on 30th September, 1872, and her symptoms observed for a few days.

On October 10th I pushed a fine trocar through the median line into the most prominent part of the tumour. Two teaspoonfuls of very thick yellow pus, and two or three minute, glassy-looking cysts oozed slowly out. Finding the fluid thus thick, and anticipating danger from retention of the contents of the cyst. I withdrew the fine cannula and introduced a No. 12 and tied it in the wound, where it pulsated strongly in unison with the abdominal aorta. About two fluid ounces of thick pus and hydatid cysts were soon ejected with intermittent spurts, and during the day about ten ounces more. In the evening the discharge became deeply tinged with bile. The cysts were very numerous, and varied in size from a line to an inch and a half in diameter, they appeared like glass or bright jelly-like spheres, and were tough and laminated. The internal laminæ were milky-white, the enclosed fluid was clear or only slightly milky, and contained colonies of living, robust scolices,

and the bodies of many were studded with bright calcareous corpuscles characteristic of the more advanced larvæ.

The same day the patient complained of much pain in the back, due, no doubt, to the pressure exerted by the cannula, for it passed through the thick wall of the cyst with some difficulty—and vomited several times.

During the next two days about twenty ounces of dark green fluid containing numerous cysts were discharged, the sickness and pain subsided, and she felt considerably relieved.

The discharge of cysts continued to the seventeenth day, and their ejection was secured by a hooked catheter wire passed through the cannula into the cyst.

The discharge of fluid was considerable, it was highly bilious for many days, and occasionally almost pure bile (dark brown and glairy), and stained the bandages sometimes deep green, and sometimes bright yellow. On the eleventh, and up to the fortieth day, the cyst was washed out every morning with iodine water (enough tincture of iodine, P.B., being added to water to give it the colour of dark sherry).

From the eleventh day to the time when the wound closed the fluid portion of the discharge was thick pus.

The cannula was removed on the thirty-fourth day and two elastic catheters introduced in its stead. As the cyst was fast contracting, and the discharge but slight, these were finally removed on the forty-third day.

On the fifty-second day she was made an out-patient. At this time she was completely relieved of her symptoms, had gained in weight from the prolonged rest, and was in perfect health. The wound, which was exactly midway between the tip of the ensiform cartilage and the navel, communicated with a sinus which allowed a probe to pass two inches, the abdomen was completely resonant below the level of the wound, and the tumour had completely disappeared. She presented herself at the hospital occasionally. The sinus was completely healed about the 200th day (June, 1873).

During the whole of the treatment there was a total absence of febrile disturbance.

A year afterwards she married, and in September, 1875, gave birth to a daughter. She suffered no discomfort during her pregnancy, and had a good labour.

I saw her in February. She had enjoyed perfect health since she left the hospital, and still retains her slender figure. A depressed scar, the size of the navel, occupies the middle line exactly midway between the umbilicus and ensiform cartilage. No trace of any swelling or of any enlargement of the liver remains at the present time (May, 1878).

CASE 2.—*Two hydatid tumours of the liver; capillary puncture of one cyst; refilling; a second puncture about fourteen weeks afterwards. After an interval of about five years, puncture with a large trocar; evacuation, contraction and healing of the sac; suppuration of a second cyst meanwhile; similar treatment and radical cure of this also.*

William C—, æt. 28, a healthy-looking, slender, active man, weighing under ten stone, was admitted under my care into Charity Ward on 24th June, 1872, for the relief of hydatid tumour of the liver.

He had been in the army and resided for two years in Malta, and had frequently drank of the impure water of the ponds there. He left the army about the year 1868, and has since followed the occupation of a shoemaker. For about two years before admission he had experienced pain between the umbilicus and epigastrium. Generally it was not very severe, but occasionally it "cramped him up." He did not observe any swelling until five months before admission, eight weeks afterwards it began to increase, and has done so rather rapidly since. Latterly it has throbbed so much (pulsation of the aorta) as to disturb sleep.

A dull, tense, fluctuating tumour occupied the interval between the ensiform cartilage and the umbilicus, it extended four inches on either side of the middle line, the lower rounded border was indicated by a fold of the abdominal wall one and a half inch above the umbilicus. Above, it was continuous with the left lobe of the liver, the most prominent part lying in the left hypochondrium, and the corresponding border of the ribs was bulged upwards and forwards. The girth of the body at the tip of ensiform cartilage, with an empty stomach and after full expiration, was thirty-three and a half inches, after full

inspiration thirty-five inches. Two inches lower down the measurements were thirty-three and thirty-four and a half inches There was no appreciable encroachment on the thoracic cavity. Pressure on the tumour caused uneasiness, and then the aortic pulsation was palpable. A capillary trocar was introduced through the middle line into the centre of the tumour. After evacuation of eight ounces of colourless almost clear watery hydatid fluid, it ceased to flow and the cannula was withdrawn.

During the next four hours there was a good deal of pain in the tumour, and he vomited frequently. The sickness continued through the night, and in the morning the face, neck, upper part of the trunk, and the arms and legs were covered with a fine urticarious rash, resembling the abundant dusky rash usually seen in the severer forms of scarlatina. Pulse 96, temp. 101° Fahr. Twenty-four hours later on the rash and other indications of irritation were absent, and the general condition of the patient was normal. The tumour was painless, free from tenderness, only barely visible, but palpable as a soft fluctuant cyst.

He continued well, and left the hospital on the thirteenth day. At this time the girth of the body at the lines above indicated was one inch less than before the tapping. During the next six weeks he presented himself occasionally for examination, and it was found that the tumour was increasing in tenseness and size; and *seventy-five days* after the operation the measurements were slightly greater than they were when the patient first came under observation. He was readmitted into Charity Ward on this day, and four days afterwards a number 12 trocar and cannula were passed into the tumour through the site of the former puncture, and twenty-eight fluid ounces of odourless straw-coloured fluid, pretty clear, but chiefly turbid, containing numerous colonies of living echinococci and shreddy membranous matter.

The cannula was secured in the wound, and an elastic catheter inserted through it. No disturbance, either constitutional or local followed; there was for some days a moderate discharge of fluid. As soon as the discharge ceased the patient, who was better, considered that the tumour was cured, and removed the cannula. When this was discovered there was some difficulty in reintroducing it, and my impression was that it did not again

enter the sac, for although it was worn, guarded by india rubber tubing inserted within it until the fortieth day, there was no discharge, and attempts to inject fluid were not successful. He left the hospital thirty days after the second tapping in perfect health, and with no evidence of any remains of the tumour.

I did not see him again until the 6th March, 1877, four and a half years after the last operation. He presented the same healthy appearance as he did at first and his weight was unchanged, and he has since had three children. He states that he has enjoyed perfect health, and has followed his occupation, which requires a position in which sitting and stooping are combined, without inconvenience.

The left costal margin is now nearly level with the right. On standing, a slight fulness of the epigastric region is noticeable. The circular depressed scar occupies the middle line at a distance of two and a half inches from the tip of the ensiform cartilage, and four and a half from the umbilicus. Between the scar and the ensiform cartilage and costal margin the abdomen is dull on percussion, the dulness being continuous with that of the liver, the left lobe of which appears to be slightly enlarged, there being a sense of fulness and resistance above and to the left of the scar, but there is neither tenderness on rough pressure nor the slightest indication of fluid, and the limits of this fulness are undefined. Around the area above indicated both chest and abdomen are healthy and resonant. The girth around the body at the lines above indicated (tip of ensiform cartilage and two and a half inches below it), was at the end of forced inspiration thirty-two inches, and at the end of forced expiration thirty inches, being three, and three and a half inches respectively, less than before the first tapping. Although it must be conceded that a cure has been effected in this case, still I do not regard it as a radical cure, meaning thereby, not only the destruction of the parasitic growth, but also the removal of the walls of the cyst and adhesions of the parts separated by it. None of the original cyst wall was evacuated, and the thickening which remains is doubtless due to the presence of the old cyst, the walls of which are still separated by some fluid derived from the same, and thickened by débris of the broken-down hydatid membrane of secondary cysts.

The above history was written for the last published volume

of the 'Hospital Reports,' but was postponed for want of time to collect and examine as I have now done in the appended Tables the cases of hydatid of the liver which have been published during the last ten years.

The delay has been fortunate in respect of this case, for towards the close of the year (1877) Wm. C— again applied to me. I had told him in March that I did not regard his cure as complete, and he presented himself at the end of September and requested that I would treat him for radical cure. He said he had been out of health lately, that he had had pain in the epigastrium (probably from dyspepsia) lasting two or three days, that he was losing flesh and felt distension of the left hypochondrium, especially after meals which annoyed him when at work (shoemaking). On standing there was a visible fulness of the left hypochondrium with slight increase of the eversion of the left rib margin. On standing the left hypochondrium presented a fulness; and a soft, dull, obscurely fluctuating tumour passed across the epigastrium, the most prominent part lay in the left hypochondrium where a rounded border was obscurely palpable, the dulness reached to within an inch of the umbilical line, and the pulsation of the aorta was felt on pressing the tumour. The body measurement on a line with the scar of the last puncture was, after forced inspiration only thirty-one and a quarter inches, and after forced respiration only thirty and a quarter, being less than I had ever found it. He was always spare, and there was not at this time any very notable loss of flesh.

Having entered the hospital (No. 1 Arthur Ward) Nov. 2nd, I proceeded to tap him six days afterwards. As he lay on his back the fulness above described disappeared, and the hypochondria declined considerably from the slightly expanded rib margins, so that a mere looker-on failed to perceive any tumour. Fluctuation, however, was sufficiently distinct, and on pushing an exploratory trocar through the old cicatrix a drop of bilious pus appeared. I immediately withdrew it, and thrust in a No. 12 trocar and cannula. Dr. Stone applied a manometer when I withdrew the trocar, and the pressure gradually rose to eleven inches of water. During half an hour ten ounces of ochre-coloured, bilious smelling, grumous fluid, containing the gelatinous débris of hydatid membrane flowed away. After

standing, the sp. gr. of the supernatant fluid which looked like thin pus was 1030, the microscope showed laminated membrane, much cholesterin, spherules of fat, and granular matter. About a pint of a similar fluid oozed away during the latter part of the day. The cannula was retained in the wound, a piece of closely fitting india-rubber tubing being inserted so as to project a little beyond the sharp edge of the cannula. From two to four ounces of a wash (composed of forty grains of crystallised carbolic acid, and 100 grains of tincture of iodine in 30 ounces of water), were injected once or twice a day. On the seventh day (after the tapping) there was free suppuration both from the sac and from the edges of the wound, and the cannula being quite free, I introduced a No. 9 elastic catheter into the sac, and removed the cannula by slipping it over the catheter. I then easily passed another catheter, a No. 5, by the side of the other, and fixed both in the wound allowing the ends to incline over to the right side. A constant oozing of inoffensive dirty ochre-coloured discharge was thus maintained until the *fourteenth day*, when pieces of bright jelly-like membrane, often stained by bile, began to obstruct the flow. On removal of the larger catheter a large piece presented itself at the surface and was removed, and a free discharge of thick yellow offensive pus followed. The old catheters were replaced by Nos. 12 and 3, and as the wash was injected by the one it freely flowed out by the other. Much pus was thus washed out, and the fluid at last ran out nearly clear. On the *nineteenth day* there was retention of discharge, the injected fluid did not return, and there was slight pyrexia (temp. 100° to 101·7° Fahr.). On removing the catheters the eyes were found plugged with fragments of cyst membranes, and a large piece presented itself at the wound and was removed. Nos. 12 and 9 catheters were introduced, and the sac was washed out with about twelve ounces of the lotion. Next day on removing the catheters a wineglassful of broken, thick, yellow, and very friable but gelatinous looking membranes came away with explosive violence, and this was followed by great relief. Other fragments still remained, and the discharge from the sac was again obstructed the same evening. Next day I was able to pass Nos. 14 and 10 catheters side by side into the sac, and after injecting a few ounces of the lotion into the cyst and then

suddenly withdrawing the catheters, a large quantity of broken membranes was discharged with expulsive force. Attempts were made to suck the membranes through the eye of the No. 14 catheter by attaching an aspirator, and although a vacuum was sustained the membranes were too tough to pass; the evacuation, however, was promoted by injecting a few ouuces of fluid, preventing its return, and then suddenly withdrawing both catheters as the patient coughed. This was done with good effect everyday, and on the *twenty-second day* a large piece of thick, bright, gelatinous membrane measuring about five inches by three appeared at the wound, and was removed by the forceps; about half a pint of offensive pus followed. This proved to be the last portion of hydatid membrane, and henceforward there was no obstruction to the flow of fluid through the catheters, the lotion passing out by one as soon as it entered by the other. The sac now soon contracted. This last portion of hydatid membrane, which from its thickness was undoubtedly a portion of the parent cyst, appears to have been slightly adherent to the liver, for the washings immediately after its removal, and on the day following were tinged brownish red. The depth of the cyst at this date was about four inches, and of late the catheters had taken a direction a little upwards and considerably over to the left hypochondrium, so that the external part of the passage was very oblique.

Excepting a slight rise of temperature as below,

2nd day	. .	p.m., 100·0°.
3rd „	. .	a.m., 100·8°; p.m., 102·2°.
4th „	. .	p.m., 100·8°.
6th „	. .	„ 101·2°.
7th „	. .	„ 101·0°.
8th „	. .	a.m., 100·0°.
12th „	. .	p.m., 100·0°.
13th „	. .	„ 100·8°.
19th „	. .	noon, 101·7°; p.m., 100°.
21st „	. .	p.m., 100·4°.
22nd „	. .	„ 100·4°,

there was no disturbance of the general health neither pain nor discomfort. The rise of temperature was coincident with and dependant upon retention of discharge from blocking of the eyes of the catheters by fragments of the membranes. An

occasional dose of castor oil was required to maintain due activity of the bowels.

On the dawn of the twenty-third day he was awoke by a sharp pain to the outside of the right nipple on drawing breath. This subsided in the course of the day, and left him entirely before the lapse of forty-eight hours. During the next week only a teaspoonful or two of pus was discharged from the cyst, the catheters being perfectly free. During the next fortnight there was a change, the fluid (about 2 oz. daily) became watery and stained brown with bile, the catheters, inserted about four inches were pushed more over to the left, the hepatic region became uneasy, rather tender and somewhat restricted in respiratory movement. The morning temperature was never under 99°, and it usually rose to 100° and sometimes to 101° in the evening. The tongue was still clean but occasionally dryish at the tip, the patient was listless, and the voice weak.

Between the thirty-eighth and fifty-eighth days a large collection of pus formed in the right hypochondrium, which became tense, hard, and completely fixed. The liver was pushed down but evidently rolled forward on its horizontal axis, for the lower edge could not be felt and pain was experienced over the commencement of the ascending colon, due I believe to its compression by the edge of the liver and retention of flatus. Still there was no obstruction to the action of an aperient. The right half of the diaphragm was pushed upwards and immovable, as were the ribs of the right side also, the lower lobe of the right lung was compressed and irritated, and there was at last a harassing cough and a little bronchial sputum, and then a little fine bronchial crepitation could be heard at the base of the lung. From the mammary line downwards to the distended colon the right side was dull. The pyrexia meanwhile continued with alternate chills by day, and heats with moderate perspiration by night. There was, however, no shivering at any time; the temperature on the thirty-eighth evening rose to its maximum 103·4°, next morning it was 98·8°, and on the evening 102·4°, but it never afterwards exceeded 101·8°. The pulse was almost always 108. The always clean tongue became almost constantly dry or dryish anteriorly. The respirations never exceeded 20. The

movement of the left ribs amply compensated for the restraint on the right side, the left hypochondrium was flaccid and resonant.

I was of course anxious to ascertain the relation of the new collection of fluid to the surface, but for some time, the only fluctuation perceptible on most careful examination was immediately in the neighbourhood (to the right of and above) of the wound occupied by the catheters. They (Nos. 5 and 8) still passed a distance of four inches but took so oblique a direction towards the left that for most of the distance they could be plainly felt through the thin abdominal wall. It was clear that they were pushed away to the left by a second cyst, and yet it was remarkable that this which produced so much distension on the right side, should not rupture into the primary sac and discharge itself by the opening which I had purposely kept large for this expected result. So I was induced to wait from day to day, but as there was no discharge from the wound, I removed the catheter on the forty-third day and introduced a long No. 10 trocar and cannula, and pushed it backwards and upwards at an angle of 45° to the surface; I ultimately passed it to the depth of four and a half inches from the skin, and as this was the only situation where there was any indication of fluctuation I expected to enter the second cyst.

The instrument passed as easily as if it was going through soft lard, but not a drop of fluid of any kind escaped. Before withdrawing the cannula I inserted a No. 8 elastic catheter, to the full depth of four and a half inches and tied it in the wound. A large linseed poultice was kept applied over the epigastric and right hypochondriac regions, and as the catheter now occupied the centre of what was apparently a fluctuant region, I hoped that soon the second cyst would form a communication with the old opening. This never occurred. A free, slimy, gamboge coloured discharge appeared on the forty-fifth day and the following week, such as would result from the introduction and retention of a catheter within the healthy liver substance. A second catheter was introduced by the side of the first, and these retained their central position until after the removal of the contents of the second cyst, when they took an oblique direction towards the *right* hypochondrium. As

the old cyst was emptied of its contents, only a teaspoonful or two of pus was discharged from the catheters and margin of the wound, after the first week. The catheter was gradually pushed out as the sinus healed, and this was finally completed on the 120th day.

The introduction of the catheter into the liver by way of the old sinus and the provocation of bilious discharge, gave slight relief; but the swelling of the right hypochondrium steadily increased, a large area of hollow resonance formed above, and I feared rupture into the lung. The patient raised himself in bed with difficulty and the face became pinched and anxious. I tried to find the proper place for puncture of the second cyst, and on the fifty-eighth day discovered clear fluctuation between the ninth and tenth ribs of the right side. There on a vertical line, one and a quarter inch to the right of the nipple, and intersected by a horizontal line drawn half an inch below the old opening, which was two inches and three quarters from the tip of the ensiform cartilage, and three inches and a quarter from the umbilicus, I inserted an exploratory trocar and cannula, and as pus spurted freely, I then and before removing the exploratory cannula introduced through the point itself a No. 12 trocar. The pressure was very great, and in the course of a few minutes four pints of intensely fœtid, dirty straw-coloured fluid, looking like thin pus, flowed away. It contained the débris of hydatid cysts in the form of minute jelly-like fragments. When the flow ceased I introduced an elastic catheter, which passed to the depth of five inches, withdrew the cannula over it, and then washed out the cyst by injecting carbolic acid and water (40 grains to a pint) until this flowed away nearly clear. About 30 ounces were so used. The hard swollen hypochondrium became quite soft and there was great and immediate relief. The discharge contained no pus corpuscles but a large quantity of fat in molecules and spherules nearly the size of pus corpuscles. The jelly-like hydatid membrane was so much disintegrated as to show no lamination. There was a large quantity of cholesterin and of another fatty matter (tyrosin?) beautifully crystallised in mossy tufts of elegantly curved needles. Small masses of yellow amorphous bile pigment and of brilliant scarlet hæmin in bold acute rhombs speckled the fluid and formed a considerable deposit.

About a pint more of the same kind of exquisitely offensive fluid was discharged during the night. Next day the pyrexia and almost all his discomfort were gone, the patient looked bright, the abdomen was retracted, the right hypochondrium quite free; there was tympanitic resonance over the margin of the ribs and two fingers' breadth above, and the catheter shared in the respiratory movements.

It was instructive to observe the relative position of the catheters. At this time Nos. 7 and 5 lay at the depth of four inches in the old wound, taking a direction backwards and slightly upwards; at right angles and nearly in a line with the end of this, another catheter lay at a distance of five inches from the surface. The girth of the body at a line drawn between the two punctures was now not more than thirty inches, the ends of the catheters therefore could hardly be more than an inch apart, and there had been enormous distension, and yet I am satisfied that the second cyst would never have broken into the first, but that its contents would very soon have made their way through the diaphragm into the lung, had not the artificial opening been made.

About a pint more of fœtid fluid was discharged during the night. In the morning the pulse and temperature were normal, the patient was bright and comfortable; the right hypochondrium was quite free, and shared in the respiratory movements, which also affected the catheter in the side.

The patient made a steady progress, retarded only by occasional impediments to a free discharge of the fluid accumulations in the cyst, from the presence of broken down hydatid membrane, and ultimately by the dense fibrous lining of the sac.

The evening temperature rose above 100° on those occasions (about six in all), but only once attained 102°. Attendant upon the partial retention of the discharge and corresponding distension of the sac, the movements of the right side of the diaphragm were diminished, the base of the right lung was a little compressed and irritated (a little fine bronchial crepitation, occasional cough, and expectoration of a little pellet of frothy mucus). The appetite continued good, and the bowels now acted without aperients.

The following is a summary of the treatment employed, and of the chief events which attended the cure:

For the first week the discharge was irregular, some days four or five ounces of yellowish offensive pus, and some days only a slight oozing between the catheter and the wound. The eye of the catheter was in fact constantly obstructed by cyst débris. By means of an aspirator attached to the catheter in the wound by india-rubber tubing, a few ounces of gamboge-coloured pus were occasionally obtained, but the suction often failed, and always the rush of fluid was sooner or later suddenly arrested by plugging of the catheter. In order to remove the single catheter with safety, so as to be able to clear away the obstructions, and to dilate the wound to facilitate their discharge, I introduced other catheters as soon as possible. On the sixth day I was able to pass No. 2 elastic catheter by the side of the No. 9 contained in the wound; and next day I introduced a second (No. 3), so as to have three catheters in the sac. The patient lay continuously on his back, and the ends of the catheters hung over a pewter vessel. I was now able to facilitate the discharge by repeatedly withdrawing and cleansing the catheters, and as often as the fluid would return, injecting the iodine and carbolic acid water (see p. 23). Even when this did not happen, and as often as the injected fluid would ultimately return wholly or in great part, I ventured to distend the sac by the injection of a few ounces of the wash, and then, on withdrawing the two larger catheters, I was occasionally rewarded by the appearance at the orifice of the wound of a piece of toughish membrane, which I could remove by the forceps. By the ninth day I had succeeded in getting No. 12, and two No. 4 catheters into the sac; and two days afterwards, after injecting four ounces of wash, I suddenly withdrew them all at once while the patient gave a few strong coughs, and repeated the process several times; by this means rather thickish and brittle fragments of hydatid membrane about the size of a shilling, and whole cysts, the size of peas and raisins, with a large quantity of thick but still offensive pus were discharged. Afterwards the injection passed by one catheter flowed away in an equal stream by the other, and the sac appeared emptied and clean. For the next few days the discharge (about one pint daily) was merely diluted bile of a

greenish-brown colour, and fresh bilious odour, sp. gr. 1014; and on the addition of acetic acid, deposited a large quantity of mucus.

For the two or three weeks following, the discharge was reduced to about an ounce and a half of thick slimy pus, almost as solid as nasal mucus, and about the thirty-sixth day there was evidence of considerable obstruction, the diaphragm being again restrained and the lung encroached upon. There was "cutting" pain just below the right nipple, and the temperature rose to 102°. After wearing a linseed poultice, which encouraged a little more oozing by the sides of the catheters Nos. 14 and 6, and getting away fragments of membrane, the pain and pyrexia soon subsided, and the patient felt quite well again a week after. On the forty-fourth day from the tapping of the second cyst, after repeated removal and clearing of the catheters, I was gratified to find a piece of membrane present itself in the passage. I removed it easily with the fingers; it proved to be the lining of the original cyst much thickened by inflammation. It was ragged, about the size of the gall-bladder, and its wall was as thick as that of this viscus. At this time it was slightly adherent to the liver, for its removal was followed by a slight oozing of chocolate-coloured blood—the first which had appeared at any time during the treatment of these two cysts.

Now the way was clear, and a little thick and still somewhat offensive pus followed. As yet there had been but little contraction of the sac, for the catheters still passed four inches and a half, but for some time the direction, which was at first transverse from side to side, became a little backwards and upwards.

A little inoffensive muco-pus was daily discharged. I soon removed the small catheter, but kept the larger inserted for an unnecessarily long time, as the patient was not inconvenienced by it either in bed or walking about. The sinus gradually healed up and pushed the catheter out.

The patient left his bed about the fiftieth day after the opening of the second cyst I kept him in the hospital until the 156th day, *i. e.* five months from the time of his admission. He gained two stone in weight during the latter part of his sojourn, and, in fact, became fatter than he had ever been. He has returned to work, and now enjoys better health than he has known for many years. He has lost excess of

fat. A cicatricial depression, a little smaller than that of the navel, occupies each of the sites of the previous openings into the two cysts. The abdominal wall immediately surrounding the epigastric one is a little prominent, but becoming less so. The abdominal and thoracic viscera are normal, and present no traces of enlargement.

The liver dulness commences about three fingers breadth below the right nipple. The measurements are as follows:— From tip of ensiform cartilage to the umbilicus 6 inches, from the former point to the epigastric scar in the middle line 2½ inches; round the body, on a level with the tip of the ensiform cartilage, 32 inches, each side measuring 16 inches; and on a line with the epigastric scar 29½ inches.

Compared with the measuremcnts six years ago, when his weight was the same, there is a diminution of about four inches in both situations; but compared with the measurements six months ago, the diminution amounts to a little less than two inches.

The following case came under my care while doing duty for Dr. Peacock, and I am indebted to him for the means of completing the history.

Case 3. *Large hydatid cyst of the liver; puncture; refilling; second puncture after an interval of six months; rupture of the cicatrised opening three weeks afterwards, and persistent purulent discharge; subsequent extension of the disease through the diaphragm; evacuation by the right lung; recovery.*

Daniel S—, æt. 15, residing at Grimsby, states that his parents are living and healthy, one brother and four sisters living and well, one brother died of convulsions and one sister died young. That he has been healthy up to three years ago, when his abdomen began to swell without any apparent cause, the swelling being greatest in the hepatic region, where he also had a dull pain. He soon had to lay up on account of the swelling of abdomen becoming greater. The swelling increased till he got so large he could not, as he states, lie down, and about eighteen months ago he was tapped below the umbilicus and more than two gallons of a yellowish-green fluid escaped.

After this he was better, the wound healed, and he was able to go about again, but six months after, the swelling, the right hypochondrium especially, reappeared, and paracentesis near the site of the previous puncture was required; but this time only about one and a half gallons of fluid came away. This fluid resembled that from first tapping, but was thicker, containing pellets of some kind. The doctor who tapped him says when he first came to him he was suffering from chronic hepatitis, which resulted in abscess, and that it burst into the abdominal cavity, which led to his tapping him twice and drawing away fluid as stated. He also stated that no sign of cysts had ever been seen, nor had the abscess any connection with the lung when under his treatment.

After the second tapping he was better and able to go out, but three weeks after the operation the cicatrix gave way and a discharge of fluid yellowish pus commenced which continued up to the time, August 12th, 1873, when he was admitted into St. Thomas's. About nine months since he began to cough and expectorate yellowish sputum similar to the discharge from the wound. Does not complain of pain in chest, but states he has a dull pain in hepatic region, has had profuse night sweats, and was considerably emaciated at first, but has gained flesh of late. Urine 1023, acid.

Aug. 18th.—He was somewhat emaciated, and had a sallow, pallid, unhealthy appearance, with glassy but pallid conjunctivæ. The chest was flattened under the clavicles on both sides, but expanded below, more on right side. Dulness on percussion commenced about the level of nipple on right side, and became entire about a finger's breadth below, at the level of fifth rib. Hepatic dulness scarcely extended below the edges of the false ribs. The respiratory sounds could be heard below the commencement of hepatic dulness, and over a limited space there was a distinct subcrepitant friction sound at the end of a forced inspiration. The dulness on percussion posteriorly commenced high up, and became entire about the middle of dorsal-region; above this point the voice had a somewhat ægophonic twang, and below, all sounds were abolished. There was a little papilla near the umbilicus, through which pus was discharged to the extent of half an ounce every day, offensive, and a little bloody. He had a violent paroxysmal cough, and brought up pus in

separate masses. He could lie comfortably on the right side, but when he lay on the left side he began to cough. He had at times, when coughing, a sense of something rising in the throat.

The expectoration at this time amounted to about two ounces a day, and had the appearance of that voided during tubercular ulceration of the lung. I had no doubt, however, that the lung mischief was due to extension of the hydatid disease, and although the diaphragm was already implicated, and probably perforated, still I thought it would be well to promote the evacuation of the cyst by the old sinus. With this view a drainage-tube was inserted through the old sinus and brought out through the skin two inches above and to the right of it. This was of no avail, and about nine days afterwards a pint of thick, slimy, ochre-coloured fluid, containing pellets of mucus minute fragments of gamboge-coloured, gelatinous membrane, proved to be hydatid by its finely laminated texture when magnified, was expectorated during a fit of coughing.

For the following week about a pint a day of similar matter was expectorated. The discharge then gradually diminished, and the patient, being greatly relieved, began to recover appetite and regain flesh. The lung dulness receded at first rapidly, and afterwards more slowly. The patient soon left his bed. He was discharged apparently in perfect health. The respiratory sounds in the base of the right lung were feeble, but no trace of tumour was perceptible.

The subject of the following notes was for some time under Dr. Weber's care in the Dalston Hospital, and I am indebted to his kindness for opportunities of examining the patient.

Case 4. *Hydatid of the liver, simple puncture; continued growth of the tumour; after an interval of several years, reappearance of the symptoms, and of others indicating pressure of the inferior vena cava, or at least of a renal vein, and of the bile duct.*

Isidor W—, between 30 and 40 years of age, was tapped January, 1857, by Dr. Langenbeck of Berlin, for the relief of a hydatid tumour of the liver which encroached upon the right lung and caused dyspnœa. A large quantity of clear salt fluid

containing clear round vesicles about the size of the end of the thumb was removed by simple puncture.

In February, 1869, he came under Dr. Weber's care for severe jaundice and great lassitude. A fortnight later œdema of the legs supervened and there was fluctuation in the abdomen, the urine was dark coloured and contained albumen.

In August of the same year I examined him and found the lower ribs of the left side everted, while those of the right side were bulged so as to form a general prominence of the lower thoracic, and hypochondriac regions of the right side. The lower edge of the liver was on a line with the navel, and the hypochondrium and epigastrium, were occupied by a dull and distinctly fluctuant tumour. A trace of the former puncture was visible over the most prominent part of the swelling on the right side. The lower part of the abdomen was flaccid and resonant.

The skin was stained by an old, icteric tinge, and he was subject to occasional attacks of fresh icterus, sometimes attended by sickness. The urine was still smoky and contained a moderate amount of albumin, and great numbers of long fine hyaline casts of the uriniferous tubules entangling many oil spherules and small fatty corpuscles. The general health was fair.

I last saw him in June, 1870. His health had improved, but the tumour was unchanged, and he was liable to slight attacks of jaundice. The renal congestion was less marked, and all trace of œdema of the legs had been absent for several months.

CASE 5. *Dry hydatid tumour of the liver discovered after death probably from suppression of urine.*

An adult male was admitted into the London Fever Hospital, under my care, December, 1866, in a state of unconsciousness and emaciation. He died in the course of twenty-four hours apparently from inanition. The abdomen was retracted, but there was enough colourless serum in the peritoneum to fill up the interstices formed by the coils of intestine. The kidneys were large, congested and minutely mottled with fatty deposit; the bladder was empty and contracted. The liver weighed 5 pounds 5½ ounces, and was in a state of advanced cirrhosis. The upper and outer (right) portion of the right lobe was occupied by a hydatid tumour, the size of a small cocoa nut; the cyst

came to the surface, but did not project from it, and was firmly adherent by bands of old adhesion to the ribs of the right side; it was of leathery consistence $\frac{1}{12}$ of an inch thick; was smooth internally and covered with a thin layer of steatomatous deposit; free from fluid, it was stuffed tightly with secondary cysts varying in size from a pea to a walnut. These secondary cysts contained fluid and numerous echinococci, and colonies of from ten to twenty inclosed microscopical tertiary cysts.

Although these larvæ were living and robust, it was evident that the advancing induration of the liver had restricted the development of the tumour.

CASE 6.—*Large hydatid cyst af the liver; accidental rupture and intense peritonitis; recovery; extension of the disease in the peritoneal cavity; enormous distension; abdomen punctured by the trocar thrice at intervals; continued swelling of the abdomen; rupture into intestinal canal, and discharge of hydatids and fluids by bowel; recovery; extension of the original cyst into the thoracic cavity; communication with the lung, and death.*

M—, æt. 28, had a large hydatid cyst of the liver for several years, but it gave him no inconvenience and he led an active life as master of a pack of sporting dogs. In an encounter with one of these he fell upon his belly and immediately experienced intense pain, and this was followed by the most intense peritonitis and his life was in great danger. He recovered, however, excepting that the abdomen was much enlarged, and resumed the occupation of the chase a month or six weeks after his accident, but found himself unequal to much exertion. The belly continued to increase in size, and was the seat of dull pain. Five months later the abdomen was tense and fluctuant from the chest to the groins, and the respiration was embarrassed. Three weeks afterwards he was comatose, the pulse was failing, and the urine suppressed; the girth of the body at the seat of the navel was forty-five inches. A trocar was introduced, and the patient was relieved of about ten pints of turbid ochre-coloured fluid full of minute hydatid vesicles the size of hemp seeds. He revived and all went well for some days, but a

fortnight afterwards the abdomen had regained nearly its maximum distension. He was relieved by a second tapping, and the issue of about eight pints of fluid and cysts like the former. This was followed by recovery so far as to allow of his leaving bed and going into the garden, but a third tapping was urgently called for eighteen days after the second. On this occasion seven and a half pints of fluid were liberated with difficulty, owing to the obstruction of the cannula by cysts. This last operation was followed by a constant pain in the abdomen; the punctures suppurated; there was shivering and anorexia, and after an interval of a fortnight he was taken in the night with an urgent desire to evacute the bowels. Several stools followed in rapid succession, and altogether about fourteen pints of fluid like that obtained by the punctures passed, only the débris of cyst membranes were more voluminous, and one of them was larger than the hand.

The abdominal swelling disappeared. For a time hydatid fluid continued to pass by the bowel. The patient recovered, and just a year after the rupture of the cyst by the fall he regarded himself as completely cured although walking caused fatigue, a full meal pain, and the stools continued watery. However, these symptoms nearly disappeared and he regained his strength and an embonpoint which he never had before. Of a cheerful and reckless disposition, he preferred a short and happy life to one of restraint, which, doubtless, would have done little to prolong it. For a year all went on well, and then the old troubles returned; loss of flesh, dull pain, shivering, fever, diarrhœa, swelling of the hepatic region, a little icterus, and redness of the legs. Nature made a final effort to rid herself of the parasite. An abscess (an extension doubtless of the original cyst) opened into the lung, and after two months of suffering the patient died.

No post-mortem examination could be obtained, and none, indeed, was needed, the patient's body having been completely riddled by art and nature in efforts to vanquish an enemy which, at the instant of death and after spoiling the rest of the viscera, held undivided sway where he had fixed his seat, namely, in the liver.[1]

[1] Dr. Bertin, 'l'Union Médicale,' 3ême séries, vol. vi.

TABLE I.—*Cases in which the cyst was punctured once or oftener at variable intervals, the opening being allowed to heal directly after each operation. In two (Nos. 51 and 52) the cyst was injected with iodine.*

No.	Sex.	Age.	Situation of the tumour and treatment.	Nature and quantity of the fluid withdrawn.	Progress.	Result.	Reference to Author.
1	F	36	Tense, elastic, fluctuant tumour, occupying the left hypochondrium and part of the epigastrium. Puncture with a fine trocar and removal of.	27 fluid ounces of fluid, at first clear, afterwards pinkish and turbid. It contained numerous echinococci.	No disturbance followed the puncture. On the 13th day, the prominence of the hypochondrium continued, there was no fluctuation, and the lower line of dulness was 1 inch higher. Five months afterwards she reported, "I have sometimes felt a little fulness in my side, and a slight pain in my back." A year afterwards it appeared from her report that the tumour was enlarging, and about 2½ years after the tapping she again came under treatment; the tumour was found to be much larger than at first, and caused much distress; a second tapping was determined on, but before it was effected an opening formed into the alimentary canal and the fluid contents of the tumour were discharged by the mouth.	Death from rupture into the intestinal canal.	Stephen H. Ward, M.D. Lancet, vol. i, 1870, p. 476.
2	M	16	Tumour of right hypochondrium and epigastrium, the size of a fœtal head, apparently continuous with the liver, moving with respiration, but without "hydatid fremitus." Aspiration one inch below ensiform cartilage three quarters of an inch to the right of middle line.	22 ounces of hydatid fluid containing echinococci.	Immediate relief. The next day bilious vomiting and very slight febrile disturbance. The progress was then satisfactory; on the 6th day the patient felt quite well, and on the 46th day the lad said he was well, and there was neither pain, tenderness, nor enlargement in the situation of the former tumour.	Recovery.	J. B. Bradbury, M.D. Brit. Med. Journal, 18th Nov., 1876, p. 647.

No.	Sex.	Age.	Situation of the tumour and treatment.	Nature and quantity of the fluid withdrawn.	Progress.	Result.	Reference to Author.
3	M	36	Tumour of the right lobe of the liver, increasing the semicircumference of the body on a level with the ensiform cartilage one inch; percussion dulness higher in front, and descending with deep inspiration; intercostal spaces obliterated, and a distinct "hydatid fremitus." Aspiration of the tumour and repetition of the operation forty-eight days afterwards.	2 pints of clear hydatid fluid by the first operation, and 1½ pints of fluid like pus by the second.	There was at the time of the operation, and had been for some months previously, considerable pleurisy in the vicinity of the tumour. All febrile disturbance disappeared after the first operation, and the patient was well and able to dance on the 21st day. A fortnight afterwards pain and the signs of pleurisy existed in the situation of the tumour, which continued, and at the time of the second operation the tumour was undiminished. Some pain, sickness, and diarrhœa, followed the aspiration, but six days afterwards his pulse and temperature were normal, and no increased liver dulness or abnormality could be detected then or 39 days later on, and a fortnight afterwards the patient reported himself as going on satisfactorily.	Relief.	J. B. Bradbury, M.D. Brit. Med. Journal, Nov., 1876, p. 646.
4	M	28	Hydatid tumour of the liver; rupture through the lung; increase of the tumour. It was tapped thirteen times in various places in the lower intercostal spaces of both sides, and in the median line over the epigastrium.	179½ ounces of fluid at first clear or bloody, and at last of a thicker consistence, were obtained.	The progress of the case is not mentioned. The chief interest in connection with it is that the patient should have escaped the dangers of so many tappings, some which "evidently missed the cyst" and drew only "bloody fluid," or were followed with no result. The pulmonary disease was greatly relieved. The case is little more than a record of these tappings, and concludes with the following:—"The presence of a morbid growth can be detected on the right side under the border of the liver.	Ditto.	John Blair, L.R.C.S. Ed. Australian Med. Journal, vol. 16, p. 329.
5	F	18	A tense, elastic tumour of the liver, occupying both hypochondriac and the epigastric regions, and extending to the right iliac region. Puncture with a fine trocar and cannula, and as-	38 ounces of clear hydatid fluid, sp. gr. 1007, and containing echinococci, were drawn off.	On the 2nd day there was pain at the site of puncture, and high fever, temp. 104°, pulse 140. This gradually subsided, and about the 5th day all danger appeared to be over. On the 12th day the pyrexia returned, and there was vomiting. On the 13th day severe pain 2 inches above the puncture; symptoms of peritonitis came on, and she sank and died on the 27th day. puriform fluid in the peritoneum. The viscera were adherent	Death from peritonitis and retention of contents	Dr. R. Scott Orr. Glasgow Med. Journal, vol. 8, p. 16. 1876.

					and hydatids. The left lobe of the liver contained a second cyst, separated from the former by a dense partition; it contained 32½ ounces of greenish-brown turbid fluid and hydatid cysts. The lungs were healthy.		
6	M	34	An elastic tumour in the hepatic region. Puncture with a trocar and cannula, and repetition of the operation after a time not specified.	60 ounces of clear hydatid fluid containing echinococci by the first operation, 40 oz. (nature not mentioned) by the second.	The first tapping was followed by localised pleurisy, the second by localised peritonitis. The man afterwards "seemed to do well, but the liver dulness in front is still about 12 inches broad, though behind it is much less."	Slight relief.	Dr. Fenwick. Brit. Med. Journal, 1876, vol. ii, p. 113.
7	F	32	Tumour of the right side of chest below the fourth rib, and of the right hypochondrium to within one and a half inch of the umbilicus. Puncture with a hollow needle and aspiration (C. D.)	16 ounces of clear hydatid fluid.	The evening after the operation she had vomiting, headache, and pain over the seat of the the puncture; 13 days afterwards there was a dull aching pain over the seat of the tumour and in the back. The patient left the hospital on the 15th day, at which time the dulness of the right side commenced at the 4th rib, and extended downwards to within half an inch of the line of dulness observed before the operation.	Relief.	Dr. Paget and Dr. Bradbury. Brit. Med. Journal, 1874, vol. ii, p. 589.
8	F	23	Hydatid tumour of right hypochondrium, extending to one third of an inch above the umbilicus. Tapping with a hollow needle and aspiration (S. U.)	16 ounces of clear fluid.	There was considerable pain in the right back two months before the operation, and later on faintness and occasional vomiting. For 4 or 5 days after the operation there was some general and local disturbance, with pain and tenderness on pressure over the abdomen, especially in the situation of the tumour, and occasional vomiting. On the 7th day the general condition was much improved. A fortnight later there was a return of the pyrexia, occasional vomiting, and an increase of the pain over the upper part of the abdomen, and on the 31st day there was much pain, nausea, evening temp. 101·6°, and pulse of 132. On the 50th day "she had very little pain in the right side, and the swelling had entirely disappeared; she could walk comfortably, but lifting a heavy weight induced the pain." She was discharged cured this day. On the 97th day she again applied on account of pain in the right side. This left her after a few weeks, and "when last heard of she was perfectly well."	Relief.	Dr. J. B. Bradbury. Brit. Med. Journal, 1874, vol. ii, p. 558.

No.	Sex.	Age.	Situation of the tumour and treatment.	Nature and quantity of the fluid withdrawn.	Progress.	Result.	Reference to Author.
9	F	20	A well-defined globular elastic tumour, about the size of an orange, apparent in the right hypochondrium. Introduction of a fine cannula and aspiration (Charlotte C.).	10 ounces of transparent, almost colourless fluid, which became bloody towards the end. No echinococci were observed.	No bad consequence followed, and the pain and uneasiness were much relieved. Her health improved, the prominence of the hypochondrium disappeared, but some remains of the tumour might be felt by manipulation. She was discharged at the end of a fortnight. After an interval of several weeks she continued quite well, and there was no return of the tumour.	Recovery.	J. D. Heaton, M.D. Brit. Med. Journal, 1874, vol. ii, p. 557.
10	M	14	Smooth, globular, elastic, fluctuant tumour of the right hypochondrium, distending the lower ribs of the right side. Girth of body five inches above the umbilicus twenty-nine inches, which in 22 days increased to thirty-one and a half inches. Introduction of a fine trocar and canula (John H.)	23 ounces of clear, colourless hydatid fluid, sp. gr. 1010, but without trace of echinococci.	No untoward symptom followed the operation, and he was made an out-patient 15 days after. About two months afterwards the boy was in good health, and no tumour was discoverable in the hepatic region. The liver dulness was 3½ inches in the middle line (2 inches less than before the operation, and 3 inches on the nipple line (3 inches less). The measurement of the abdomen at the line above mentioned was 26½ inches (5 inches less).	Ditto.	G.H.Phillipson, M.D. Brit. Med. Journal, 1874, vol. ii, p. 557.
11	M	20	A tense, fluctuant tumour of the right hypochondriac and epigastric regions, extending to the umbilicus and the left hypochondrium. Puncture with the finest exploratory cannula and aspiration. After twenty-one days a second operation similar to the first (Robert S.)	By the first operation 46 fluid ounces of perfectly colourless, transparent fluid, sp. gr. 1007·8, containing hooklets By the second 35 ounces, yel-	A moderate degree of pain was experienced for three days after the first operation, but there was no pyrexia. He left bed at the end of a week. The fluid reaccumulated. During the second operation the evacuation of the cyst was prevented by obstruction of the canula. The patient was kept under observation for a considerable time, and when last seen the swelling in the hepatic region had very much diminished.	Relief.	Dr. R. Scott Orr. Glasgow Med. Journal, vol. viii, p. 13, 1876.

			Subsequently pain and friction sound over the sac. Puncture with a fine trocar at the outer edge of the right rectus (John M.)	cannula.	health."		Clin. Soc. Trans vol. i, p. 29.
13	M	29	Fluctuating swelling of the right hypochondrium. Puncture with a fine trocar and cannula.	16 ounces of hydatid fluid, containing hooklets.	With the exception of the occurrence of some pain in the side and slight febrile disturbance on the 4th day, which symptoms speedily subsided, the recovery was uninterrupted, and he was discharged cured on the 20th day.	Ditto.	Mr. T. Sympson Brit. Med. Journal, 1870, vol. i, p. 438.
14	M	24	Smooth, elastic, fluctuant tumour of the right hypochondrium, extending towards umbilicus and down to the iliac fossa. Puncture with a very fine trocar (C. H.).	53 ounces of almost clear fluid, sp. gr. 1005, containing echinococci.	With the exception of a slight febrile reaction lasting about forty hours the patient did well, and at the time of his discharge it was very doubtful whether there were sufficient positive signs of the tumour refilling.	Relief,	Dr. Southey. Brit. Med. Journal, 1870, vol. ii, p. 138.
15	F	25	Vibratile tumour of epigastric and hypochondriac regions, reaching to within two inches of right iliac crest and four inches below left costal cartilages. Girth at widest circumference thirty-two inches. Puncture with a Thompson's trocar, through linea alba, slightly beneath ensiform cartilage. Five days afterwards repetition of the operation one inch to left of linea alba. On the nineteenth d tapped a third time between and below the previous punctures (Emma R.).	"Less than half a pint of light yellow, slightly turbid fluid, sp. gr. 1009, containing hooklets." No fluid escaped by the second puncture, the cannula having been plugged by two minute cysts. About 4 ounces or more of fluid, sp. gr. 1009, containing fragments of membrane and a few bits of stained, shrunken hydatids, and free from pus.	The tumour had existed several years. Three years before treatment she had miscarried. Jaundice appeared four months before admission, when it was considerable. She was relieved by the first operation, and next day the jaundice was less. The second was followed by a good deal of diffuse pain over the abdomen, but five days afterwards she was feeling very well, the jaundice was considerably less, and the girth was 1 inch less (31 inches). Some pain followed the third operation, and the girth was reduced another inch. She was discharged at her own request on the 28th day with the view of readmission. At this time she had some jaundice, and the girth had increased to 31 inches.	Ditto. but subsequent increase of the tumour.	Dr. Duckworth Brit. Med. Journal, 1871, vol. ii, p. 179.

No.	Sex.	Age.	Situation of the tumour and treatment.	Nature and quantity of the fluid withdrawn.	Progress.	Result.	Reference to Author.
16	F	25	A bilobed elastic tumour of the epigastrium, some bulging of the lower right ribs. Hepatic dulness rose to level of third right rib and to the heart. Puncture two inches and a quarter below the ensiform cartilage and a little to its right. About four months afterwards puncture a second time (Mary A. J.).	33 ounces of a fluid, in tint like pale urine, proved by nitric acid to be due to bile-pigment, sp. gr. 1014, with a trace of albumin, pus (?), and disintegrating echinococci. By the second tapping 72 ounces, rather turbid, bilious, and of the colour of porter.	There was slight icterus on admission. No tumour could be felt after the operation. A severe attack of jaundice with great pain in the region of the liver complicated the progress. On the 3rd day the epigastrium was again the seat of a fluctuant tumour as large as before the operation. She was discharged about a month afterwards; then the epigastric tumour had diminished somewhat in prominence and tension, yet the area of hepatic dulness was quite as great as before the operation. The patient was subsequently readmitted for a second operation. About two months afterwards it is stated, "the patient has progressed so far favourably."	Relief.	Dr. Ransom. Brit. Med. Journal, 1872, vol. ii, p. 354.
17	F	20	Globular, elastic tumour of epigastric and right and part of left hypochondriac regions. Puncture with a fine trocar and cannula (Emma B.).	4½ ounces, limpid, sp. gr. 1009, containing echinococci and a decided trace of albumin.	Pain and sickness immediately followed the operation; the following day, general urticaria; on the 4th day, condition normal; on the 7th, a relapse, and increase of temperature and pulse, and acute lancinating pains all over the body. On the 31st day, when the patient left the hospital, the tumour was smaller, and a diminution was found at each succeeding examination.	Ditto.	Dr. Ransom, loc. cit.
18	F	21	An elastic tumour in the epigastrium, with bulging of the lower portion of the chest wall, and liver dulness ten inches in the vertical direction [illegible] tilage.	13½ ounces, clear, non-albuminous, sp. gr. 1007. No trace of echinococci was found.	At the conclusion of operation, and for some days after, the patient was very sick and faint; there was also a rise of temp. and pulse, and at times severe abdominal pains. The day after the operation general urticaria was present; on the 5th day the condition was almost normal. Three weeks [illegible] there was bulging under the right mammary region, and	Ditto.	Dr. Ransom, loc. cit.

					left below the ribs was decidedly less than on the previous examination, the tumour was distinguishable but small, and the bulging of the right thorax remained.		
19	M	27	Obscurely fluctuant tumour of the lower half of the right thorax, the right hypochondrium, and part of the axillary region. Puncture with a fine trocar and cannula. Vertical measure of hepatic dulness in the right mammary line nine inches and a half (S. R.).	28 fluid ounces of transparent, watery fluid, containing numerous echinococci and free hooklets.	The operation was followed by rigors, abdominal tenderness, and tympanitis. Temp. 100°, and pulse 104. But these symptoms soon declined, and on the 4th day the vertical dulness had decreased 3 inches, and the semi-circumference of the body ½ an inch. A month later the liver dulness extended an inch lower. Diminution, however, to this extent occurred during the next month, and about six months after the operation there was a further decrease of an inch in the vertical dulness.	Ditto.	Dr. Duffin. Clin.Soc.Trans vol. vi, p. 23. Lancet, 1869, vol. i, p. 158.
20	M	3	Hydatid tumour of the liver. Puncture with a fine trocar on two separate occasions (Robert R.).	Half a pint of clear fluid, containing living echinococci, by the first operation; no mention of that obtained by the second.	The cyst refilled, and a second tapping was necessary. After this it contracted permanently, and the child was quite well when last seen.	Recovery.	Mr. P. H. MacGillivray. Australian Med. Journal, 1872, p. 212.
21	F	13	Tense, fluctuating tumour of the left hypochondrium, and enlargement of the right side by a second cyst. Puncture of the tumour, and a month afterwards puncture with a fine trocar through one of the lower right intercostal spaces (Mary C.).	14 ounces of clear fluid containing healthy echinococci by the first operation. 2 pints of clear fluid with numerous, live, healthy echinococci by the second.	There were evidently two separate cysts in this case, the fluid obtained by both operations being simple hydatid fluid, containing living echinococci. After the left hypochondrium was punctured the swelling of the right side increased. The second operation was followed by pleurisy and fever. The cyst on the left side refilled. The case was still under treatment when the report was printed, and it seemed probable that the cyst first operated on would require puncture again.	Relief.	Mr. P. H. MacGillivray, loc. cit.

No.	Sex.	Age.	Situation of the tumour and treatment.	Nature and quantity of the fluid withdrawn.	Progress.	Result.	Reference to Author.
22	F	26	Globular, fluctuant tumour of the epigastric and right hypochondriac regions. Vertical dulness in right mammary line seven inches, in the left five inches and a half. Apex of the heart corresponded to the fourth interspace. Puncture with a fine trocar and cannula (Sarah B.).	21 ounces of healthy hydatid fluid.	Severe pyrexia with pain and tenderness in the hypogastric region and abdomen generally, with nausea, for the four days following the operation. On the 5th day the tenderness over the liver was much less, and from this time the progress was favourable. On the 16th and 23rd days the liver dulness was the same as before the operation, excepting a decrease of 1 inch vertically. The woman left the hospital feeling well at the latter date. Six months later the hepatic dulness was less in every direction, the position of the heart was normal, all prominence in the epigastric region had vanished, and the vertical measurements were 6 and 4½ inches.	Relief.	Dr. Duffin. Clin. Soc. Trans vol. vi, p. 24.
23	F	29	Rounded tumour of epigastrium and right hypochondrium. Girth over the greatest prominence thirty-two inches. Liver dulness in the right axillary and xyphoid vertical lines nine and a half inches and twelve inches respectively. Puncture with a fine trocar, and on the ninth day the cyst was again tapped (Louisa C.).	¼ ounce of ordinary hydatid fluid by the first puncture. 28 ounces, slightly opalescent, sp. gr. 1014, throwing down by heat $\frac{1}{10}$th its volume of albumen, containing hooklets and granular and fatty detritus, by the second.	In the evening after the first operation there was slight pyrexia, and a sense of tension and aching in the side and back, which subsided in 24 hours. During the following eight days the temp. was about 1° above normal, and the pulse slightly quickened. The dimensions of the tumour were unchanged. No constitutional disturbance followed the second puncture. On the 14th day (five days after the last puncture) the girth around the body was reduced 1½ inches, the vertical dulness in the situations previously indicated was 7 and 6½ inches respectively. At the end of fourteen weeks the liver was not more than an inch in excess of its normal height.	Recovery.	Dr. Duffin. Clin. Soc. Trans vol. vi, p. 27.
24	M	42	Smooth, globular, tense, fluctuating tumonr of the epigastric and hypochondriac regions, encroaching on the regions.	8½ pints of pus. 3 ounces of the fluid were much clearer than the rest, and flocculent. It	The progress was in most respects satisfactory, but little abdominal tenderness followed the operation; the swelling returned after a few days, but gradually subsided. There were five periodical (about every fifth day) rises of tempera- right side of the thorax. He was made an out-patient on	Ditto.	J. B. Bradbury, M.D. Brit. Med. [illegible] p. 290.

				been for years, and Dr. Bradbury could detect nothing abnormal either in his abdomen or thorax."			
25	M	50	Tumour of the right hypochondriac and epigastric regions. Hepatic dulness reached to the umbilical level. Puncture with a small trocar (William N.).	64 ounces of clear hydatid fluid.	About three weeks before the operation there were coarse friction sounds over a portion of the tumour, and great pain in and about it. On the second day the pain was less, and there was no bad symptom. Steady recovery ensued, and three weeks afterwards the size of the liver but little exceeded the average.	Ditto.	Dr. Johnson. Clin.Soc.Trans vol. vi, p. 30.
26	F	52	Enormous hydatid tumour of the left lobe of twenty-five years' standing. Abdomen distended and fluctuant. Girth of body fifty-six and a quarter inches. Tapping (Mary A. P.).	After the removal of hydatid membrane, 31 pints of dark, greenish-yellow, opaque fluid, sp. gr. 1016, very albuminous and bilious.	There was much abdominal pain and tenderness and flushing before the operation, and she became very much worse after it. The cyst rapidly filled again, and on 5th day had reaccumulated. She sank rapidly, and died in much pain. The tumour was found to fill the abdominal cavity, extended into the pelvic cavity, and was adherent to the fundus of the uterus and to the abdominal walls and viscera generally. The walls of the tumour were exceedingly thin and soft, and very easily torn. It was full of bile-stained fluid, and a large number of cysts, varying in size from a hazel nut to a cocoa nut, some collapsed and empty, others full, and some of them containing clear fluid.	Death, with reaccumulation and retention of fluid	Dr. Fuller. St. George's Hos. Rep., vol. v, p. 257.
27	F	13	A large fluctuating tumour of the right side. Tapping (Elizabeth K.).	77 ounces, clear, slightly straw-coloured, containing echinococci.	The cyst refilled in great measure, and then seemed to contract somewhat. As the hospital was very much crowded at the time, the girl was sent home, and her parents were instructed to bring her again in a few weeks, but nothing more was heard of her.	Relief.	MacGillivray. op.cit., case 27, vol. xii, p. 73.
28	M	6	A small fluctuating tumour of the right hypochondrium. Puncture with a small trocar (Thomas H.).	2 ounces, clear, containing echinococci.	The patient was discharged 15 days after the operation, with no appearance of the tumour remaining.	Ditto.	MacGillivray. Case 35, op.cit. vol. xii, p. 78.
29	F	11	A tense, fluctuating tumour of the right side. Puncture with a fine trocar (Louisa J. M.).	18 ounces, clear, containing echinococci.	The cyst did not refill, and she was discharged eleven days after the operation.	Ditto.	MacGillivray. Case 36.

No.	Sex.	Age.	Situation of the tumour and treatment.	Nature and quantity of the fluid withdrawn.	Progress.	Result.	Reference to Author.
30	M	17	A fluctuating tumour of the left hypochondrium. Puncture with a fine trocar (Thomas R.).	70 ounces, clear, the latter portion rather milky, and containing echinococci.	The tumour caused some distress in breathing before it was tapped. It did not refill, and the patient was discharged thirteen days after the operation.	Ditto.	MacGillivray. Case 38.
31	F	23	Tumour of the right side. Puncture with a small trocar (Mary C.).	114 ounces, clear and limpid, containing echinococci.	A few days after the operation the cyst partly refilled, but contracted again. She was discharged three weeks after the tapping, and neither then nor nine months afterwards was there any appearance of tumour or swelling.	Recovery.	MacGillivray. loc. cit., Case 24, vol. xii, p.
32	M	5	Small fluctuating tumours of right hypochondrium, of the left iliac region, and of the left hypochondrium, successively appearing in this order. The cysts were punctured with a fine trocar at intervals of five and twelve months respectively, the punctures of the r. and l. hypochondrium separated by an interval of at least four inches (Martin A.).	1 pint from the right hypochondrium. The same quantity from the left iliac region, and 10 ounces from the left hypochondrium. In each case the fluid was clear and contained echinococci.	Neither of the cysts refilled, and at the time of operation on the third cyst no trace of the former two could be discovered. But since his discharge, after the second tapping, "he had suffered frequently from severe cough, and his parents said he had occasionally expectorated pieces of white skin 'like tripe,' which, no doubt, were fragments of hydatid cysts. There was marked dulness over almost the whole of the right side of the chest, more decided inferiorly." He was discharged twelve days after the last operation.	Ditto, with discharge by the lung	MacGillivray. op. cit. Case 262. vol. xii, p. 72.
33	M	56	Large, tense, fluctuating tumour. Tapping with a fine trocar, and the operation repeated a fortnight afterwards (James W.).	1½ pint, containing echinococci. At the second operation 1 pint.	The cyst apparently gave way about two months before the first tapping, indicated by sudden burning pain in abdomen diminution of the size of the tumour, and intense urticaria for three days. The cyst refilled after this and after the first tapping, but no enlargement was apparent afterwards, and at the end of the 3rd month "there was still no appearance of any tumour."	Ditto.	MacGillivray. Case 3, loc. cit. vol. x, p. 245.
34	M	28	Enormous fluctuating tumour, occupying he tgreater part	Nearly a gallon and a half.	The tapping was followed by acute peritonitis, from which he died four days after the operation. The cyst	Death	MacGillivray.

Tapping with a large trocar (Matthew N.).

			T.).		were several cysts and that the patient was in a hopeless state.	eighteen	op. cit.
					daughter-cysts were found in the liver, one having over a hundred, ranging in size from a pea to a walnut.	after from extension of the disease.	1865. p. 245.
36	M	27	A deeply seated obscurely fluctuating tumour. Tapping (Charles S.).	—	Had been previously in another hospital, where a tumour of the abdomen had been twice tapped. He was discharged about six weeks after the 3rd tapping, seemingly well.	Relief.	MacGillivray. Case 7, loc. cit. vol. x, p. 246.
37	M	45	A large, tense, fluctuating tumour of right side of abdomen, expanding the lower ribs. Tapping with a fine trocar, and repetition of the operation forty-five days afterwards (James B.).	9 pints of clear hydatid fluid by the first, and 5 pints of bile-tinged fluid by the second operation.	The skin was slightly jaundiced before the first operation. The cyst had not refilled at the time of his discharge about a month after the last operation.	Recovery.	MacGillivray. Case 15, op.cit. vol. x, p 249.
38	M	47	Fluctuating tumour of abdomen; ascites and some general dropsy; whole of right side of chest dull. Tapping of the right hypochondrium with a fine trocar. Operation repeated a second time after some weeks, and again ten months after admission (Peter O.)	2 quarts of hydatid fluid. 1½ pint by the second operation.	There was dyspnœa and slight hæmoptysis, and the first operation was employed as a palliative. Great relief was experienced for some weeks, at the end of which time the tumour was enlarged to its former dimensions. Acute peritonitis followed the 3rd tapping, and the man died on the 4th day. Three large cysts were found, two on the liver, one of which had compressed the right lung and caused the dulness, and one on the omentum. They contained a few, but not many, free daughter-cysts.	Death from acute peritonitis.	MacGillivray. Case 9, loc. cit. vol. x, p. 247.
39	M	45	Tumour occupying both hypochondria. Puncture of the right with a fine trocar, and after an interval of ten days puncture of the left tumour.	40 ounces from the right tumour, and 60 from the left.	"He made a good recovery, and the cysts have not refilled." No mention, however, is made of the time when the patient was last seen.	Recovery.	Mr. Gunning. Australian Med. Journal, vol. xx, p. 252.

No.	Sex.	Age.	Situation of the tumour and treatment.	Nature and quantity of the fluid withdrawn.	Progress.	Result.	Reference to Author.
40	F	6	Globular, fluctuating tumour of the epigastrium. Puncture with a fine trocar (Elizabeth C.).	14 ounces of colourless, slightly opalescent fluid, of sp. gr. 1010, in which no trace of echinococci were found.	Several attacks of vomiting (the effect of chloroform?) the night following the operation, and for the next two days moderate pyrexia. From the 10th to the 24th day slow increase of the tumour, and subsequently a diminution. When last observed, three months after the operation, "there was no perceptible bulging, and scarcely any tumour to be felt," the girth (22½ inches) midway between umbilicus and ensiform cartilage was 3¼ inches less.	Recovery with remains of the tumour.	Murchison. Lec. Diseases of Liver, 1877, 2nd ed., p. 92, Case xviii.
41	F	31	Smooth, fluctuant tumour, occupying the whole of the left hypochondrium. Puncture with a fine trocar (Emma H.).	20 nunces, limpid, sp. gr. 1009, the last few ounces 1012, and contained blood and bile pigment.	No disturbance followed the operation, she left the hospital 18 days afterwards; subsequently bore two children; 3½ years after the operation a small, hard, non-elastic, painless tumour, could still be felt in the epigastrium, but caused no inconvenience.	Ditto.	Murchison. op. cit., p. 93, Case xix.
42	M	35	Liver much enlarged, the portion below the ribs being smooth, painless, elastic, and almost fluctuating. Two exploratory punctures with a trocar were made at an interval of a week (Thomas B.).	No fluid was obtained by the first puncture, the cannula proving too short. About 6 ounces of thin, purulent, bilious fluid were obtained by the second.	A fortnight before admission he had jaundice and diarrhœa, which had been preceded by severe pain in the right side. There was a moderate amount of ascites. Diarrhœa, nocturnal sweating, irregular rigors and emaciation were the prominent symptoms. No bad consequences appeared to follow either operation. The patient died 32 days after admission, and a fortnight after the last puncture. A hydatid cyst as large as a child's head projected from the under surface of the liver, and compressed the portal vein and bile ducts; the outer surface of the liver was coated with recent lymph.	Death.	Murchison. op. cit., p. 119, Case xxxvi.
43	F	60	Large, smooth, obscurely fluctuant tumour of right hypochondrium. Puncture with a fine trocar and cannula, and aspira-	6 ounces, faintly opalescent, sp. gr. 1010, containing echinococci.	No bad symptom followed the operation, and in 1¾ years, and again 3 years afterwards, there were neither pain nor swelling, and the health was good.	Recovery.	Murchison. op. cit., p. 94, Case xxi.
			trium, most prominent to the left of the middle line.	fluid by the first operation.	the action of the exhausting syringe caused so much dorsal pain and faintness that an endeavour to further empty the cyst was abandoned; urticaria, but no bad symptom,	Recovery ?	Murchison. op. cit., p. 87. Case xvi.

			use of an exhausting sy-	opalescent, colour-	extended from the epigastrium into both hypochondria,		1868.
			Eight months afterwards tapping with a fine trocar (John N.).	sp. gr. 1009, containing echinococci.	right. No disturbance whatever followed the second operation. Eleven days afterwards the patient left the hospital apparently well and without tendency to enlargement of the tumour. Four days later on he was attacked with severe typhus; the tumour at first appeared to enlarge, but by the time of convalescence it had quite subsided again. About 3 months after the last operation, and again at the end of 1¼ year, no trace of a tumour could be felt.		
45	F	25	Smooth, painless tumour of left hypochondrium. Puncture with a fine trocar (Mrs. R.).	40 ounces, limpid, sp. gr. 1010.	One the 3rd day the temp. was 102·5, pulse 96; on the 7th day she left bed, but the tumour was slightly larger, pulse 84, temp. 101·5°. On the 14th day she resumed her stays, which she had laid aside for years; pulse 90, temp. 101°, A month later she was much better, the semi-girths were equal and 14½ inches, that of the left having decreased 2 inches. There was no sign of tumour about 3½ years after the operation, and the health was excellent.	Recovery.	Murchison, op. cit., p. 93, Case xx.
46	M	36	Smooth, round, elastic tumour of the right hypochondrium, reaching to the umbilicus. Puncture with a fine trocar and cannula (Deacon B.)	16 ounces, clear, sp. gr. 1009.	No inconvenience followed the operation. He left bed on the 3rd day, and soon after left the hospital. On the 40th day, the girth of the body over the tumour was 1¼ inches less than before the operation; there had been some uneasiness about the tumour. Three months later the tumour was imperceptible, and, excepting flatulent dyspepsia, the health was good.	Ditto.	Murchison, op. cit., p. 96, Case xxiv.
47	F	31	Tense, elastic, almost fluctuating tumour of the right hypochondrium, eventually becoming very painful and tender. Puncture with a fine (No. 1) trocar (Hannah S.).	12 ounces, clear, limpid, sp. gr. 1009.	There was retention of urine the day following the operation, and on the second day the abdomen was distended and tympanitic, skin hot and dry, temp. 101°, pulse 120, and much thirst, but still less pain and tenderness over the tumour than before the operation. On the 6th day the above symptoms had subsided, and on the 32nd day the patient left the hospital, the tumour was soft and free from tension, and the vertical liver dulness was diminished 1¼ inch. During the next three years the patient followed her occupation as cook, and at the end of this time only a slight fulness was perceptible in the epigastrium. About 14 months afterwards she was confined of a living child. She was subsequently readmitted for the relief of dyspepsia, flatulency and hysterical pains; a hard mass the size of an orange could still be felt in the site of the tumour; it was painless, and did not seem to be connected with the patient's symptoms.	Relief.	Murchison, op. cit., p. 89, Case xvii.

No.	Sex.	Age.	Situation of the tumour and treatment.	Nature and quantity of the fluid withdrawn.	Progress.	Result.	Reference to Author.
48	M	8	Globular, smooth, painless, fluctuating tumour connected with the upper surface of the liver, and depressing the viscus. Girth of body over the most prominent part 25 inches. Puncture with a fine trocar and cannula (Albert D.)	6 ounces, clear, sp. gr. 1011.	Some febrile disturbance followed, but subsided after four days. The patient left the hospital on the 14th day, the girth being reduced ¾ of an inch, and the swelling being much less prominent and tense, but to the right of the cyst which had been tapped appeared to be a second, in which, however, fluctuation was not very distinct.	Relief.	Murchison, op. cit., p. 94, Case xxi.
49	M	25	A prominent tumour projecting from the right lobe of the liver. Puncture with a fine trocar and cannula (Mr. P.)	8 ounces, thin, turbid, sp. gr. 1010, containing pus, cholestrin hooklets, and shreds of membrane.	For three or four days after the operation much pain and sickness. After 14 days the tumour was smaller. The tumour soon enlarged to nearly its original dimensions (7½ inches in both directions), but ultimately was reduced to 4½ and 5½.) Seven months after the operation he had no discomfort from the tumour, which continued to get smaller and felt harder; he was much stouter, and the general health was excellent.	Recovery.	Murchison, op. cit., p. 95. Case xxiii.
50	M		Large tumour of the liver. Simple puncture (Isidore W.).	A large quantity of clear salt fluid, and small hydatid vesicles.	At the end of a fortnight it was thought unnecessary to tap the tumour again; but it subsequently increased, and produced intermittent jaundice, and probably albuminuria.	Temporary relief	Case 4 of the present paper, p. 323.
51	F	43	Hydatid cysts of the liver. Two or three were punctured and their contents removed by the aspirator. Four months afterwards the cysts were again tapped and injected with tincture of iodine.	Clear, alkaline, and slightly albuminous fluid, containing much chloride of sodium but no echinococci. The nature of the fluid subsequently evacuated	A slight rise of temperature followed the first operation, but she was discharged a week after it. The tumour began to increase from this time, and she was re-admitted four months afterwards. The injection of iodine caused pain, but very little constitutional disturbance. She continned to improve, and was discharged a month afterwards. Some months afterwards she was greatly improved in health; but no mention is made of the condition of the abdomen.	Recovery ?	Dr. R. G. Alexander. Lancet, vol. i, 1875.
52	M	30	Large, fluctuant tumour of the epigastric, umbilical,	85 ounces of clear, colourless, hydatid	The patient was discharged, greatly relieved, 16 days after the operation. At the time of the second operation the	Recovery.	S. W. Fearn. Brit. Med.

			lumbar regions, the liver dul-	By the second punc-	caused some pain and smarting. No further note was made		vol. ii, p. 496.)
			higher than the right nipple. Puncture with a small trocar. 14 weeks after a second tapping and injection of the cyst with diluted tincture of iodine (James C.).	turbid whey-like fluid.	Fifteen months after the last tapping the hepatic dulness was still excessive, extending almost as high as the right nipple, and lower than normal. The patient was perfectly recovered, and the right lung, which was compressed, worked healthily and easily, and there was neither pain nor bad breathing.		
53	M	34	Multiple hydatid tumours of liver. Puncture of anterior fluctuating space, of fluctuating space to the right of this, and of fluctuating space between 10th and 11th ribs at the back, by a fine trocar, at intervals of nine and sixty days respectively (Henry A.).	4 oz., 7 oz., and 1½ oz. of clear hydatid fluid respectively.	Some uneasiness of the side, flatulency, diarrhœa and jaundice, which existed before the treatment, persisted to the 103rd day, when he left the hospital.	Relief.	Murchison, Case xxvi, op. cit., p. 99.
54	M	45	Multiple hydatid tumours of the liver and peritoneum, nodulating the enlaged abdomed. Puncture with a small trocar of a small cyst overlying one on the left lobe of liver. After an interval of a year puncture with a fine trocar of a large cyst between the umbilicus and sternum. Paracentesis abdominis on the fifth day, and removal of 140 fluid ounces of serum; sp. gr. 1016, loaded with albumin (Charles M.).	A drachm and a half clear alkaline fluid by the first, and 28 ounces of similar fluid by the second operation; sp. gr. 1009	There was constant interruptions to the flow at the second operation. On the 23rd day, and for the week following, there was considerable pyrexia and ascites, œdema of the legs. Enlargement of the veins on the abdominal wall, which existed on his readmission, increased considerably, and the girth of the abdomen (44 inches) was 4 inches more; orthopnœa severe. The removal of peritoneal fluid gave relief; fluid did not accumulate; the œdema almost disappeared from the legs. The patient was able to leave bed a month afterwards, and he seemed as well as usual, but on getting into bed his breathing became suddenly embarrassed, and in twenty minutes he was dead. Nothing was found to account for death. The cyst last tapped contained 6 pints of hydatid cysts, and thin pus. Another cyst in the right lobe of liver contained 4—5 pints of thin opaque fluid, bile pigment and a few hydatid cysts. There were numerous smaller cysts in the liver, and on the surface of omentum and other parts of the peritoneum.	Sudden death, probably from increasing pressure on the diaphragm.	Murchison, Case xxviii, op. cit., p. 102.

No.	Sex.	Age.	Situation of the tumour and treatment.	Nature and quantity of the fluid withdrawn.	Progress.	Result.	Reference to Author.
55	F	23	Fluctuant tumour of right hypochondrium displacing the right lower ribs outwards, and descending very nearly to a level with the umbilicus. Insertion of a grooved needle. Destruction of an area of skin by caustic potash,* and puncture through the base of the deep ulcer with a medium-sized trocar(M. B.).	A jet of clear fluid by the grooved needle A quart of clear hydatid fluid, containing numerous hooklets, by the cannula.	Three days after the operation the patient left her bed free from pain and much relieved of the uneasiness which the distension had before occasioned, the tumour was nearly gone, and the distortion of the body diminished. No return of the enlargement occurred. She was seen at considerable intervals, and continued well, the tumour having quite disappeared.	Recovery.	Dr. J. D. Heaton. Brit. Med. Journ., 1869, vol. i, p. 309.
56	M	24	Fluctuating tumour of right hypochondrium; a second projecting from lower margin of left lobe; a third projecting behind the first; subcutaneous veins, on right side of trunk enlarged. Evidence of slight ascites; deep jaundice for about twenty days; persistent diarrhœa and dyspnœa; slight crepitation at base of right lung. Puncture of cyst in right lobe with exploratory trocar. Two days later the cyst in left lobe was punctured	By exploratory puncture 7 ounces, viscid, yellowish, purulent, with shreds of hydatid membrane and blood crystals. By the second puncture only a few drops of fluid. By the third 80 ounces of yellow pus, with collapsed hydatids and fragments of cysts; the last few ounces deeply tinged with blood.	No constitutional disturbance followed the punctures, and great relief followed the third. On the 21st day the patient left the hospital, the girth over the most prominent part of the abdomen being half an inch less (38 inches) than when he was admitted. On account of the hæmorrhage no attempt was made to empty the sac; on the contrary, the cannula was withdrawn, and the opening sealed by collodion. After his discharge the tumour continued to increase, and on the 31st day profuse diarrhœa came on with the discharge of hydatid membranes per anum. On the 36th day the jaundice had disappeared, the girth was reduced to 3½ inches, but the patient became suddenly collapsed, and died the next day. There was recent peritonitis in the neighbourhood of the liver, and the peritoneum contained a pint of fluid. The common bile-duct was dilated, and opened into two large communicating cysts in the r. lobe. The lower (the one which was punctured) contained much reddish [illegible]	Death from peritonitis and exhaustion induced by inflammation of the cyst and attempts to empty itself through the common bile-duct	Murchison. op. cit., Case xxxi, p. 109.

* Dr. Heaton informs me that he has now discarded the painful and dilatory process of making an eschar before puncturing.

			with a fine trocar, and four car was passed into the cyst in right lobe, and the operation was repeated five days later (Charles W.).	By the fourth containing much blood, partly clotted, and hydatid membranes.	numerous hydatid cysts up to the size of an orange, and rated from the wall of the cavity, and this was lined with flocculent lymph. The upper cyst contained similar matters; it was adherent to the diaphragm, and this to the base of the lung; the diaphragm was perforated, and the adherent lung was broken down to the extent of about a cubic inch. A third cyst projected from the anterior margin of the l. lobe.		
57	M	28	Hydatid tumour of liver. Rupture from fall, peritonitis, followed by great enlargement and fluctuation of abdomen. Paracentesis, repeated twice at intervals of fourteen and eighteen days.	10 pints of turbid, ochre - coloured fluid, and with small hydatid vesicles; 8 pints of similar fluid; and 17½ pints, respectively by the three punctures.	The first operation aroused the patient from a moribund condition, the second gave relief, the third was followed by a constant pain in the abdomen, shivering, suppuration of the punctures, and after a fortnight rupture of the cyst into the intestinal canal and discharge of 14 pints of fluid and cyst membranes per anum, some very large. A year after the first puncture recovery with disappearance of the abdominal swelling. At the end of two years reappearance of the hepatic tumour, with icterus, rupture through the diaphragm, discharge by the lungs, and death 2 months afterwards.	Death from extension of the disease into the lung, and exhaustion.	Case 6 of this paper. see p. 325.

TABLE II.—*Containing cases treated by electrolysis; by simple puncture followed by electrolysis* (*Case* 66); *and by acupuncture* (*Case* 67).

58	F	7	Smooth, round, fluctuating tumour of right hypochondrium, bulging the ribs. Electrolysis under chloroform; current passed 20 minutes (Susan B.).	A drop of clear fluid escaped when the lower needle was withdrawn.	A severe paroxysm of pain an hour afterwards, but it soon passed off. No further notes. Discharged twelve days after. About nine weeks later the tumour was still plainly to be felt. About a year after the operation the Surgical Registrar failed to discover any tumour in the abdomen.	Recovery.	Dr. C. Hilton Fagge and Mr. Durham. Medico-Chir. Trans., vol. liv, Case 1, p. 2.

No.	Sex.	Age.	Situation of the tumour and treatment.	Nature and quantity of the fluid withdrawn.	Progress.	Result.	Reference to Author.
59	M	17	Tumour in the right lobe pushing up the diaphragm and bulging the ribs. No fluctuation. Needles inserted, one between 8th and 9th cartilage six inches and a half from median line; the other between 9th and 10th two inches further outwards. Electrolysis during 25 minutes (William P.).	—	Pain in the chest followed the operation, with a rise of temperature and retention of urine. Next day the pulse and temperature were normal, the third day there was moderate pyrexia, and signs of fluid effusion in right pleura, to the nipple in front, and to four aud a half dorsal spines behind. This had disappeared on the tenth day. The tumour gradually subsided, and about four months after the operation there was no difference in outline between the two sides of the chest, and no indication was left of the disease. Two years later he was still in perfect health.	Recovery.	The same. Case 2, p. 5.
60	M	13	Two elastic tumours, "one occupied the epigastric region, extending on the left to the level of the nipple, and downwards to midway between the ensiform cartilage and the umbilicus. The other was situated on the right side, and extended from the margin of the ribs to the crest of the ilium." A "third" hydatid tumour of the liver was tapped and transparent fluid withdrawn.		Urticaria was the only disturbance that followed the operation. At the end of three weeks the parts in the position of the tumonr were quite flaccid. Later no trace of the two cysts could be felt, but the liver was considerably enlarged. About a year after the operation there was still a little fulness of epigastrium, but no defined tumour could be detected. In the spring of the following year the patient came under Dr. Rees's care with a "third" cyst, according to Dr. Philips, in a "position different from that of either of those previously operated on."	Relief, subsequent extension of the disease.	The same. Case 3, p. 11.
61	M	4	Double hydatid tumour occupying the epigastrium and right hypochondrium. Electrolysis of each cyst under chloroform (Alfred H.)	—	Seven hours and a quarter after the operation there was slight fluctuation in the lower part of the abdomen; next day more distinct, and pain. The patient quickly returned to his original health, but the tumour continued to increase, and about thirteen weeks after the operation the left tumour reached nearly to the umbilicus, while the one on the right side had subsided. Twenty-one months after the operation the liver was still low down, but the size.	Relief.	The same. Case 4, p. 12.

			convex surface of liver, the most prominent distinctly fluctuating, occupying the left hypochondrium, another bulging the right ribs, a third seemingly projecting from the under surface of the liver, the lower edge of which reached the right iliac fossa. Electrolysis under chloroform of the left tumour, and after eleven days of the right one (C. S.).	fluid followed the removal of one of the needles.	softer and could not be distinctly felt. Next day pain [illegible] softer. Distinct fluctuation at lower part of abdomen. 2nd day.—Measurement of abdomen increased 1 inch. 3rd day.—Fluctuation less distinct; measurement as before the operation. After the second operation (11th day) no fluid could be detected in the abdomen; there was much pain. Next day distinct fluctuation both in the cyst and lower part of abdomen. 13th day.—Abdomen fluctuant, increase of girth 2½ inches. On the 28th day there was no doubt about the diminution in the size of the tumours. Six months afterwarns an obscure fulness was all that remained of the large tumours.	[illegible] recovery.	The same. Case 5, p. 18.
63	F	9	Bulging of lower part of chest, of right side and front of abdomen, from 6th rib, in mammary line to level of navel, an elastic feel, but no fluctuation nor thrill; edge of liver sharp and defined. Electrolysis (E. M.).	—	Pyrexia the evening after the operation and four days following; temp. from 102·6° Fahr. to 99·8°. On the 10th day there was a general rash resembling scarlatina, and and evidence of fluid in the peritoneal cavity. On the 4th day tumour decreased; no longer elastic. 14th day.—There was still bulging of the right side, but the swelling had considerably decreased. 7 months after "the tumour had entirely disappeared, leaving at most a slight fulness of the epigastrium; the ribs had returned to their proper position.	Ditto.	The same. Case 6, p. 22.
64	M	5¾	Slightly thrilling tumour of the epigastrium slightly bulging the right ribs; right lobe of liver pushed downwards nearly to the crista ilii. Electrolysis under chloform (Alfred C.).	Two drops of clear strongly alkaline fluid followed the removal of one of the needles.	The evening after the operation the upper part of the abdomen was soft and pulpy; fluctuation, if any, was very doubtful. On the 2nd day the body girth measured 1¼ inch less; next day 2 inches less, and the next 22 inches, the size before the operation. No constitutional disturbance occurred, and the child left his bed on the 5th and the hospital on the 10th day. A month after the operation he was readmitted with signs of consolidation of the apex of right lung. The tumour was then much less defined. A year and a half later, traces of the tumour were still perceptible.	Ditto.	The same. Case 7, p. 24.

No.	Sex.	Age.	Situation of the tumour and treatment.	Nature and quantity of the fluid withdrawn.	Progress.	Result.	Reference to Author.
65	F	27	A firm, elastic, indistinctly fluctuating, but thrilling tumour, pushing out the lower ribs on the right side, and extending to within $3\frac{7}{8}$ inches of the anterior superior spine of ilium, and $1\frac{3}{8}$ inch of the umbilicus. Electrolysis 16 minutes (Eliza M.)	A little fluid escaped as the needles were withdrawn.	Considerable pyrexia followed the operation, and had not subsided at the end of 19 days. On the 5th day shivering. On the 10th and 18th days the tumour was undiminished, but scarcely so tense. There was still dragging pain in the hypochondrium. On the 32nd day there was a decided diminution in the tumour, and he was in good health. 9 months after the operation there was but little trace of the tumour. The health was excellent.	Recovery.	The same. Case 8, p. 28.
66	F	14	A tense obscurely fluctuating tumour of the epigastrium. Puncture with a fine trocar, then electrolysis. One needle only introduced for 5 minutes (M. M.)	2 ounces of clear watery fluid were removed by the trocar.	Slight disturbance followed. The tumour was "almost quite gone" 30 days after the operation, but the lower edge of the left lobe of the liver could be traced an inch above the umbilicus.	Relief.	Dr. C. Handfield Jones. Med. Times & Gazette, vol. i, 1874, p. 421.
67	F	$6\frac{3}{4}$	Tense, hard, indistinctly fluctuating, spherical tumour of the right hypochondrium, descending below the level of the umbilicus. Introduction of 2 fine gilt needles under chloroform, for 5 minutes (Esther C.).	—	Immediately after the operation the tumour was considered to be less tense and prominent. The temperature began to rise soon after, and in 24 hours after reached 102°, falling next morning to 98·6°, but fluctuating for some days, the highest being 102·6° on the 4th day. Besides this there was no disturbance. The tumour underwent gradual but progressive diminution, and when last seen less than a month after the operation it could be detected only by manipulation as a soft, rounded, readily movable mass.	Recovery.	Dr. Fagge and Mr. Durham. Med.-Chir. Trans., vol. liv, Case 9, p. 43.

TABLE III.—*Containing cases in which the tumour was punctured once or more, and a communication with the interior of the sac maintained at first or subsequently.*

68	F	39	Tumour of the left hypochondrium, descending to about two inches above the [illegible] car and cannula, an inch to	1 ounce of clear, transparent fluid. Obstruction by a [illegible] its removal about	About 40 hours after the first operation rigor, nausea, and bilious vomiting, severe pyrexia with pain, and tenderness in the epigastrium, and uneasy breathing ensued. On the [illegible] to 104 Fahr. From the 10th to the 13th day the tumour increased. After the introduction of the large	Radical cure.	Dr. Duffin. Clinical Soc. Trans. [illegible]

			and nearly four inches from the surface. Insertion and retention of a cannula the size of No. 7 catheter on the 14th day, and on the 17th it was replaced by one the size of a No. 14 catheter (Mary Ann S.).	fluid.	ounces of pus and hydatid were evacuated daily. The cyst did not decrease, and pyrexia recurred. The day after the insertion of the largest cannula 21 ounces of mixed pus and hydatids were evacuated. A fall of pulse and temperature and sleep resulted. On the 19th day the pus was free from fœtor. Collapsed cysts continued to be evacuated daily in abundance till the 27th day with 4—6 ounces of pus. The suppuration then diminished, the tumour receded, the general health rallied, and on the 71st day the fistula had completely healed.		
69	F	8	Tense, elastic tumour, projecting into the epigastrium. Tapping with a a fine trocar, and repetition of the operation twice at intervals of two months. About five months after the first operation a large trocar was used, and a drainage tube retained in the sac (Amelia H.).	1 pint, clear, by the first; about 1 ounce only by the second; about 1 ounce of healthy pus by the third; and about 1 pint of fœtid pus by the fourth operation.	The patient was discharged about a fortnight after the first tapping with nothing noticeable except a slight bulging of the liver. She was readmitted 18 days after, and again discharged 16 days after the second tapping, and attended as an out-patient, but becoming weak and hectic from suppuration and enlargement of the cyst she was admitted a third time. The third operation was followed by relief, but shortly after she became much worse, the tumour being very much enlarged. After the insertion of the drainage tube the discharge continued for about 3 weeks, when the child was quite cured, and about a month later was running about hearty and well.	Radical cure.	Mr. MacGillivray and Dr. Atkinson. Australian Med. Journ., Case xiv, vol. x, 1865, p. 248.
70	M	32	Tumour, size of a fœtal head, occupying the epigastric and parts of the right and left hypochondriac and umbilical regions. Puncture with a small trocar, and after nine or ten weeks puncture with a large trocar; injection of the cyst with a pint of warm water. Wound allowed to close; reopening on the 6th day, a drainage tube inserted, and the sac washed out with solution of potassic permanganate (James T.).	11 ounces, clear, citron coloured; portions of hydatid membrane obstructing the flow. 25 ounces of thin pus, and an enormous number of hydatids by the second tapping. On reopening the wound 18 ounces of putrid sanious pus.	A friction sound was heard over the tumour before the operation, and it had become painful. No special annoyance followed the tapping, and the man left the hospital on the 8th day with the liver undiminished. Readmission 2 months afterwards, when the tumour was larger and painful, and the patient was feverish and losing flesh. Material relief followed the second tapping, but the old lumbar pains returned 4 days afterwards, and 2 days later the swelling and pyrexia were again found to be rapidly increasing. Very great relief followed the free evacuation of the contents of the cyst, and from this time the patient did well. The discharge of hydatids continued for a time, sometimes obstructing the drainage-tube, but the sac contracted. At the end of 2 months the man left the hospital. 7 months from the second tapping the fistula was healed, and the liver dulness was of normal dimensions.	Ditto.	Dr. G. Johnson. Clin. Soc. Trans., vol. vi, p, 31.

No.	Sex.	Age.	Situation of the tumour and treatment.	Nature and quantity of the fluid withdrawn.	Progress.	Result.	Reference to Author.
71	M	61	Tumour of the right hypochondrium. Puncture with a fine trocar, and 3 weeks after with a large trocar, insertion of a tube (William G.).	2 pints, clear, living echinococci by the first operation; and by the second a quantity of pus and cysts.	Suppuration followed the first operation. A perfect cure resulted from the second and the after treatment.	Radical cure.	P. H. MacGillivray. Australian Med. Journ., 1872, p. 212.
72	F	39	Rounded, fluctuant tumour of the right hypochondrium. Puncture with a small trocar. A month (30th day) afterwards, repetition of the operation; the wound was left open and a poultice applied. On the 41st day tapping with a large trocar, injection of solution of carbolic acid (1 in 30) through an elastic catheter introduced six or eight inches. Cyst washed out daily with carbolic acid water.	3 pints of perfectly clear, hydatid fluid sp. gr. 1012, by the first operation. 1½ pint of yellow, opaque, purulent fluid, sp. gr. 1020 by the second An enormous quantity of horribly offensive, greenish fluid, followed the last puncture.	The cyst had refilled on the 4th day. On the 6th day there was slight discharge from the puncture, and some constitutional disturbance. Subsequently this was much increased, and she had rigors, due to retention of the discharge. After the evacuation of the contents of the cyst were freely provided for, there was great improvement in health. Many large pieces of cyst-wall came way. 3 months after the first operation, and 50 days after the last, the discharge was less, and she was gaining flesh. At the end of about 6 months she was discharged cured.	Ditto.	Mr. T. Sympson. Brit. Med. Journ., 1870, vol. i, p. 437.
73	M	35	An indistinctly, fluctuant tumour of the right hypochondrium, extending below the umbilicus and a little to the left of the median line. Use of the aspirator, and immediately afterwards the with a scalpel, two inches	Only a few drops of thick, offensive, greenish fluid were obtained by the aspirator. 60 ounces of purulent matter membrane flowed	The patient was liable to "ague" attacks. He vomited soon after admission, and the skin was recently jaundiced. At the time of the operation the temperature was 103°, the pulse 120, and respirations 36. He was very prostrate, and appeared to be suffering great pain. His expression was that of extreme anxiety, and his voice was reduced to a whisper. The operation gave great relief continued for some time. On the 14th day a probe passed	Ditto.	Dr. Ramsgill, Brit. Med. Journ., 1874, vol. ii, p. 619.

			inches in the wound. On the 48th he had another evanescent attack of pyrexia, the flow at the time was irregular. On the 65th day the discharge had ceased, the wound was apparently closed, the jaundice had disappeared. He had gained considerably in weight, and expressed himself as being "very well."					
74	M	35	Fluctuating tumour of the epigastric and hypochondriac regions. Puncture with a fine trocar and cannula, and repetition of the operation a month afterwards (31st day). On the 39th day puncture with a small trocar, and as no purulent fluid escaped immediately afterwards a large trocar and cannula were introduced, and the hydatid vesicles cleared out of the latter with a feather. The cannula was retained in the wound. On the 61st day it was withdrawn, and a laminaria tent introduced instead. On the 63rd day a large drainage tube was introduced into the sac. The sac was washed out with 2 per cent. solution of carbolic acid, and about 2 ounces of a solution of iodine 6) drachms of the tincture to twenty ounces of water) were injected on the 74th, 79th, and four following days, and on the 87th day the sac was cleared out, and a solution of iodine again injected (W. B.).	The first puncture liberated 24 oz. of hydatid fluid, sp. gr. 1005, neutral; at first clear and afterwards like milk and water. The second was followed by the discharge of 24 ounces of neutral fluid, sp. gr. 1005. On the 39th day about 8 ounces of purulent fluid and hydated vesicles, up to the size of a racquet ball, were drawn off. A spontaneous discharge of similar fluid and vesicles occurred occasionally, and by the aid of a feather from 3 to 80 ounces of similar discharge were from day to day liberated.	The first puncture was followed by moderate constitutional disturbance, but no local pain or tenderness. On the 6th day he fainted twice, and the conjunctivæ were a little yellow. On the 21st day the abdomen was almost as large as before the tapping. 9 days after the second tapping the girth over the tumour was 1½ inch more than it was before the first puncture. As soon as the discharge became free the patient improved, and sat up on the 60th and 61st days. The tent had slipped into the sac, but came away two days afterwards. About the 78th day there was retention of the discharge, which became fœtid. After the sac was cleared and iodine injected on the 87th day, the patient complained at once of great pain, went to bed, and had a violent rigor followed by great collapse. Next day all unpleasant symptoms had passed off, there was no distension nor great tenderness of the abdomen, and a good deal of dark offensive discharge came away through a tube introduced into the cyst. From this time recovery was uninterrupted. On the 123rd day he had the appearance of health, and 7 months after the operation the liver dulness was normal, and the opening in the abdomen had quite healed.	Ditto.	Dr. J. B. Bradbury. Brit. Med. Journ., 1874, vol. ii, p. 494.

No.	Sex.	Age.	Situation of the tumour and treatment.	Nature and quantity of the fluid withdrawn.	Progress.	Result.	Reference to Author.
75	F	32	Large, obscurely fluctuating tumour of the epigastric and hypochondriac regions extending to the lumbar and umbilical regions. Introduction of aspirator needle, and immediately afterwards a trocar and cannula. Introduction of an india-rubber tube through the cannula and removal of the latter. On the 42nd day insertion of a large tube, together with a laminaria tent, which were removed the next day, the old tube being reintroduced. On the 65th day the use of a laminaria tent, and the next day the introduction of a larger tube (A. A.).	The discharge was slightly purulent from the first. 9 ounces were removed on the 1st day before the introduction of the tube. It contained numerous fat particles, granular matter, a few corpuscles, and much cholesterin. On the 20th day the first hydatid vesicles were discharged.	Considerable pyrexia followed the operation. Free discharge from the tube occurred only at intervals. On the 18th day there was very little through the tube, but a free discharge between it and the edge of the opening itself. Signs of lung inflammation arose, and the cough gave great pain in the tumor. Two days afterwards the pulse was 124, and temp. 102° to 104·2° Fahr. There was evidently an obstruction to the free discharge of the contents of the cyst until the 43rd day, when a free evacuation, including what appeared to be the parent cyst, followed the removal of the tent and larger tube. On the 57th day 16 ounces of thick brownish-red pus came away with a number of small cysts. Between this date and the 65th day the opening was not sufficiently patent, and the progress of the patient was hindered. After the last appliance a large quantity of pus strained away and the patient improved much. She left the hospital wearing a drainage-tube on the 86th day, and attended as an out-patient until the wound was healed. About a year and a half afterwards she applied for relief for a cough, which soon left her, and when last seen there was no evidence of any hepatic tumour, and she was quite well.	Radical cure.	Dr. J. B. Bradbury. Brit. Med. Journ., 1874, vol. ii, p. 559.
76	F	Adult.	An indistinctly fluctuant tumour of the right hypochondrium and epigastrium. Introduction of a grooved needle and then a large trocar; imposition of an elastic tube through the cannula and removal of the latter. Three weeks afterwards	A pint or more of clear hydatid fluid,	No other symptoms followed the tapping. After 3 weeks the patient had some constitutional disturbance, due to retention of the discharge, which was at this time purulent and rather fœtid. After enlarging the opening a large quantity of fœtid hydatid *débris* and purulent fluid escaped, and subsequently there was a copious discharge of pus, which after a time was stained yellow, and sometimes the discharge was almost pure bile. During the progress of the case there were two rather and the discharge diminished.	Ditto.	Dr. Humphry. Brit. Med. Journ., 1874, vol. ii, p. 588.

			under chloroform, and the passage of carbolised water		The wound was allowed to close very slowly, and thus healing was attended by a radical cure.			
			of a gum-elastic tube, nearly one inch in diameter, in the wound. In course of time a smaller tube was substituted for the larger, and retained for some months until the discharge had nearly ceased.					
77	F	32	A freely movable indistinctly fluctuating tumour, about the size of an ox kidney, across the abdomen, a little below the umbilicus. Puncture with a capillary trocar and aspiration. A week after, a repetition of the operation, and twenty-five days afterwards a free incision along the linea alba to the surface of cyst, and insertion of a large trocar and cannula, then free incision of the cyst, evacuation of its contents; the edges of incision and cyst wall stitched together, and two large drainage tubes inserted into its cavity, and antiseptic dressing used.	At the first and second operations a few ounces of turbid fluid. None passed through the large cannula. The incision set free a large quantity of hydatid cysts, floating in a purulent fluid.	The first tapping gave relief, but the tumour regained its original size before the second tapping, which caused a rapid increase, inflammation of the cyst, rigors, high pulse, temperature 103°, and a feeling that he should die if not relieved. The tumour became fixed, tender, and as large as a child's head before the cyst was freely laid open, after which the patient progressed favorably. The cavity of the cyst gradually contracted to a small sinus, which ultimately closed, and the patient was discharged cured on the 108th day after the first puncture.	Radical cure.	Thomas Annandale, F.R.S.E. Brit. Med. Journ., January 27th, 1877, p. 99.
78	F	17	A tense, elastic tumour of right hypochondriac and epigastric regions. Two unsuccessful attempts at puncture. A third puncture with No. 8 trocar, midway between umbilicus and ensiform cartilage caused the evacuation of . . . . . Cannula retained till the 25th day. A catheter subsequently introduced daily, and the cyst washed out.	Only 1 drachm of clear, non-albuminous fluid obtained by the first punctures. 26 ounces of turbid, semi-purulent fluid, with a piece of hydatid membrane.	A little general uneasiness followed the first two punctures. After the 3rd the discharge was free, and sometimes stained with bile for the first 20 days. During the next 5 there was none, and on the 35th day pain and constitutional disturbance. On the 37th the opening was seen to be plugged by hydatid membrane. The next day the whole mass of hydatid membrane and several pints of very offensive purulent bile-strained fluid was expelled, the pain and swelling disappeared, the discharge decreased from day to day, and on the 68th day the wound was healed.	Radical cure.	Dr. Owen Rees and Mr. Thomas Bryant. Path. Soc. Trans., vol. xviii, p. 168, 1866.

No.	Sex.	Age.	Situation of the tumour and treatment.	Nature and quantity of the fluid withdrawn.	Progress.	Result.	Reference to Author.
79	F	37	Dull, fluctuating tumour of the liver, encroaching on the chest and raising the ribs, especially on the right. Girth of body at navel level 35½ inches. Vertical incision two inches long, ending at three inches above the navel, and insertion of a piece of chloride of zinc in the wound for 24 hours. Free incision of the hydatid cyst on the 17th day, and daily injection of iodine water or solution of permanganate of potash.	5 quarts of limpid, inodorous, non-albuminous fluid were evacuated when the cyst was opened, and a week afterwards false membranes and hydatid *débris* were discharged.	The action of the caustic was very energetic, and caused great pain and high fever for some days. After incision and evacuation of the cyst the body measurement was reduced to 26½ inches. On the 105th day the cyst was about 2 inches deep.	Radical cure.	M. Demarquay Gazette Médicale de Paris, 1872.
80	F	23	A dull, deeply fluctuant tumour of the right hypochondrium, raising the seventh, eighth, and ninth ribs. The measurement of the right side six inches more than that of the left. First day puncture with small-sized trocar and cannula, and closing of the wound. Twelfth day puncture with a large-sized trocar, plugging of the wound with the application of a poultice for the next nineteen days.	6 ounces of clear fluid was discharged by the first operation. 12 ounces of turbid fluid, deeply tinged with blood, by the second, and small hydatid cysts were discharged daily for about twelve days on removing the lint plug	No bad effects followed the first puncture, but there was soon evidence of reaccumulation of fluid. No constitutional disturbance, no peritoneal tenderness, followed the second tapping and the means subsequently used to keep the passage of the cyst open. On the 30th day the sinus had contracted, and as the introduction of the lint gave pain and there had been no further discharge of cysts it was allowed to close spontaneously. This was effected on the 56th day. "A little difference caused by the thickening around the ribs over the liver" was still observable, but there was a difference of only 2 inches between the measurements of the right and left side.	Ditto.	Mr. Charles Brook. Lancet, vol. i, 1868, p. 162.

			epigastrium.	til towards the	and the hospital 11 days, afterwards. After the lapse of	Radical cure.	Case 1 of this paper,
			car. Nearly 5½ years later puncture with a large trocar; maintenance of the opening, and injection of antiseptic and irritating fluids; complete evacuation of the contents; contraction and healing of the cyst (Sarah R., now D.).	from echinococci. By the second operation, thick, sweet, "laudable" pus, with glistening hydatid vesicles, containing colonies of living echinococci.	by its pressure. The second operation was followed by relief, and about 60 days afterwards a radical cure was virtually effected, only a sinus about 1½ inch deep remaining. This was allowed to heal very gradually.		
82	M	28	Two hydatid tumours of the liver. (*a.*) The *left*:—Puncture with capillary trocar, and fourteen weeks after with a large trocar; retention of the cannula in the cyst for a week, and in the liver for about three weeks. After an interval of five years puncture with a large trocar; retention of cannula; injection of antiseptic and irritating fluids; complete evacuation of the contents of the cyst; contraction and radical cure, (*b.*) The *right* cyst:—Thirty-eight days after the last operation on the left cyst the right one was opened and treated in the same way (William C.).	8 ounces, clear, hydatid fluid; 28 ounces of odourless, straw-coloured fluid, partly clear, but chiefly thickish and turbid, like thin pus, containing living echinococci and *débris* of membranes; and 30 ounces of thick, grumous fluid, containing bile, cholesterin, and *débris* of hydatid membranes; by the three punctures of the left cyst, respectively. From the right cyst, 4 pints of turbid, fœtid fluid, with cholesterin, hydatid *débris*, and pigment crystals.	Relief without the supervention of any untoward symptoms followed all three punctures. The tumour speedily refilled after the first, and 50 days after the second there was no evidence of the presence of any remains of the tumour. This was still obvious after an interval of 4½ years, but six months later on there was an unmistakable return of the old symptoms, including fluctuation. At the time of the evacuation of the lining membranes of the left cyst, evidence of suppuration and distension of another in the right hypochondrium close to the diaphragm arose, and on the 38th day relief was afforded by letting out the putrid contents of the cyst, after which the patient made a rapid recovery.	Radical cure of both cysts.	Case 2 of this paper.

No.	Sex.	Age.	Situation of the tumour and treatment.	Nature and quantity of the fluid withdrawn.	Progress.	Result.	Reference to Author.
83	M	10	Suppurating tumour of left hypochondriac and epigastric regions. Aspiration. Nine days afterwards, an exploratory puncture made, followed by an incision. The aspirator was again used on the 14th day, and carbolic lotion (1 in 50) injected. The cyst was tapped on the 30th day, and on the last occasion carbolic lotion was again injected. A drainage tube was passed through the cyst on the 45th day, and on the 47th the incision was enlarged, and the cavity washed out completely and the contents evacuated. The cyst was afterwards frequently injeeted with carbolic acid water (Alfred T. D.).	A little turbid fluid were obtained by the first aspiration; a little serum with pyoid corpuscles by the exploratory puncture; the incision gave exit to pus and blood. By the second aspiration 60 oz. of offensive pus were drawn off, and the subsequent tappings let out 38 and 24 ounces of pus respectively. Much foul pus, and the remains of hydatids (including apparently the mother sac) were liberated by the last operation.	There had been considerable pyrexia before the first operation, and there was very little amelioration until the day after the second tapping (30th) when a spontaneous discharge of about a pint of offensive pus was followed by a normal pulse and temperature. The drainage-tube proved useless. From the time the external opening was freely enlarged the patient improved steadily. A fortnight later the cyst had completely shrunk. On the 75th day the sinus was still open, discharging slightly, and the patient was in good condition.	Radical cure.	Dr. C. H. Jones. Med. Times and Gazette, 1874, vol. i, p. 420.
84	F	32	Smooth, elastic, fluctuating tumour of epigastrium and both hypochondria. Liver dulness in mesial line eleven inches. Slight ic-	60 ounces, limpid, alkaline, sp. gr. 1009. No echinococci were observed.	For 24 hours nfter the puncture there was some febrile disturbance. She left bed on the 7th day: On the 13th day rather severe febrile symptoms recurred (pulse 120, temp. 103·8°). Next day there was pain on deep inspiration in the region of the tumour. This was followed by a	Radical cure.	Murchison, Dis. of Liver, 1877, Case xxv, p. 97.
			Puncture with a fine trocar and cannula.	operation about a pint of thin fœtid	retching, coarse moist sounds over lower end of both lungs and enlargement of the tumour. On the 30th		

			Repetition of the operation on the 53rd day, and Vienna paste over the site of the puncture. On the 57th day incision into the eschar, puncture with a large trocar, and washing of the cyst with solution of chloride of zinc (gr. x to ℥j). On the 66th day the insertion and retention of a perforated drainage tube, and the use of solution of chloride of zinc (Hannah B.).	pus. By the third 90 pus, with numerous large shreds of hydatid membrane.	day there was a second slight rigor, but improvement followed. On the 53rd day the pain in the tumour and incision, but returned with great dyspnœa as the opening became choked up a few days after. On the 85th day enormous masses of parent cyst were discharged, and this was followed by rapid improvement. The tube was removed on the 134th day. She left the hospital a month later with the wound almost cicatrised.		
85	F	24	Tumour of the right lobe of the liver, causing bulging of the ribs. Exploratory puncture between sixth and seventh ribs in front, and two days later a free incision at the same spot; the cavity washed out with solution of chloride of zinc (gr. xx to ℥j), and a piece of elastic tube left in the opening, through which a weak solution of carbolic acid was daily injected (Miss M.).	3 drachms of pus by the exploratory puncture; 4 pints with numerous large hydatid cysts by the incision.	The severe pain from which the patient had previously suffered was at once relieved by the incision. Much pus and hydatids continued to be discharged for 20 days, when what appeared to be the parent sac escaped. After this the discharge rapidly diminished. On the 41st day the patient was in excellent health. On 61st day the tube was removed, and the opening soon after closed.	Radical cure.	Murchison, op. cit, Case xxxv, p. 118
86	F	39	Globular, elastic tumour, the size of a cocoa-nut, projecting downwards from the right lobe of liver. Puncture first with a small and then with a large trocar, retention of the cannula, and washing out of the sac from time to time. (Elizabeth R.).	Clear fluid and a number of hydatid cysts.	There was slight jaundice before the operation. This disappeared on the 4th day. On the 12th day she was weak and anæmic. On the 21st day she had great pain in the right side, fever, cough, expectoration of mucus stained with bile and consolidation of base of right lung. On the 49th day these symptoms continued, and the external opening was closed. On the 89th day the base of the right lung was clear, the expectoration had ceased, and about 5 weeks later she was able to leave the hospital.	Radical cure by rupture into and evacuation by the lungs.	Murchison, op. cit., Case xxx, p. 108.

No.	Sex.	Age.	Situation of the tumour and treatment.	Nature and quantity of the fluid withdrawn.	Progress.	Result.	Reference to Author.
87	M	15	Large tumour extending below the umbilicus. Puncture with a large trocar. Repetition of the operation after six months (Daniel S.).	More than 2 gallons, yellowish-green, by the first puncture; about 1½ gallons of thicker fluid, containing pellets of some kind (doubtless hydatid vesicles), by the second.	Relief followed both operations, but 3 weeks after the second the cyst refilled and ruptured through the tender cicatrix formed in the site of the second puncture, but as no attempt was made to enlarge the opening the discharge (now pus) was insufficient to relieve the enlarging cyst. A year afterwards when he came to St. Thomas's the cyst had perforated the diaphragm, and the lung was extensively involved. A few weeks later the contents of the cyst were discharged by the mouth, and recovery was speedily effected.	Radical cure by rupture into and evacuation by the lung.	Case 3 of this paper.
88	F	12	A large, fluctuating tumour in the epigastrium and right hypochondrium. Puncture with a fine trocar, and the operation repeated after a fortnight. About three weeks after tapping with a large trocar; insertion and retention of a large catheter for ten weeks (Caroline W.).	A quantity of clear fluid, containing echinococci by the first; milky fluid, containing echinococci, but no pus, by the second; and 1½ pint of pus and cysts by the third operation.	The tumour refilled after the first and second tappings. Pus and cyst continued to escape from the catheter in small quantities for some weeks. The discharge having ceased about 10 weeks after the last operation the catheter was withdrawn. Shortly afterwards pleuro-pneumonia of the right side suddenly came on, and the dulness extended over the whole of the right side. The disease ran its usual course for 3 or 4 weeks, when the cough and expectoration became less, excepting dulness, and complete absence of respiration over the front to considerably above the nipple; the lung completely recovered. As this side increased 1 inch more than the left it seemed probable that the circumscribed dulness was due to a hydatid cyst. The lung was punctured in in several parts about the centre of the dulness, but nothing escaped except a few drops of blood, and the patient afterwards complained of a good deal of pain in the side, and expectorated blood for 2 days. She was discharged about 6 months after admission.	Uncertain. Most probably the cyst extended into the base of the lung.	MacGillivray, op. cit., Case xxxiii, vol. xii, p. 77.
89	M	18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

			lobe of the liver, occupying hypochondriac regions, including the splenic, spreading out the lower portion of the chest wall, and descending to a line with the umbilicus. It produced great dyspnœa, but there was no jaundice. On the 1st day exploratory puncture, and after four applications of caustic (potash, and afterwards Filloz's caustic) the cyst was opened two fingers breadth below the false ribs. On the 31st day it was washed out by means of an india-rubber tube twice a day with alcoholized water, and subsequently injected with water containing $\frac{1}{20}$th part of tincture of iodine.	clear, citrine fluid, echinococci were evacuated. When the opening was effected on the 21st day about 7 ounces of a brown, bilious fluid, containing gelatinous flocks, but no trace either of hydatid membranes, or of *debris* of echinococci and similar fluid continued to be discharged. On the 33rd day the discharge of hydatid membranes commenced.	effect of the prolonged application of caustic is not [illegible] great relief. All went on well until about the 35th day, when the tumour was still very obvious in the left hypochondrium, although it was considerably diminished. At this date the liquid became fœtid and the injections almost insupportable, the cavity of the cyst did not appear to retract, slight hæmorrhage occurred on two occasions, and hectic appeared. On the 82nd day the patient died of general peritonitis, which supervened suddenly, The external opening communicated by a fistulous passage the size of a finger, and between $\frac{3}{4}$ and an inch long, with the cyst which was less than the fist in size, and occupied the left lobe of the liver. It contained some spoonfuls of purulent sanies. At the posterior part of the sac there were two openings leading into a cavity half the size of the principal one formed of false membranes lying between the liver and the diaphragm. This cavity communicated on the left with the peritoneum. The spleen was compressed and small, and there was recent peritonitis. The lungs, especially the right, were covered with resisting adhesions.	rupture into the peritoneum.	cale, 3me ser., [illegible] 1868.
90	F	27	A round, painful tumour of the right hypochondrium. Tapping with an exploratory trocar. Repetition of the operation about seven weeks afterwards. About two months later puncture with a large trocar, insertion and retention of an elastic catheter for 6 or 7 weeks (Mary G.).	10 ounces, clear, limpid, containing echinococci by the first operation. About 10 oz. of of milky fluid by the second. A quantity of pus and collapsed small cysts by the third.	There was considerable bronchitis and hacking cough before the operation, and these symptoms were much relieved by it. The cyst refilled after the first and second operations. For the first 3 weeks after the last tapping small cysts escaped at intervals, and a little discharge of pus continued until 3 weeks before her discharge, when it ceased altogether, and the tube was withdrawn. No enlargement of the liver was perceptible, and she seemed perfectly cured. Shortly after her discharge she was attacked with dysentery and died. No post-mortem examination could be obtained.	Death whether from the effects of the hydatid disease or of some other is doubtful.	MacGillivray, op. cit., Case xix, vol. x, p. 250, and vol. xii, p. 70.

No	Sex.	Age.	Situation of the tumour and treatment.	Nature and quantity of the fluid withdrawn.	Progress.	Result.	Reference to Author.
91	M	32	A large, fluctuating tumour of the right side of abdomen. Tapping with a fine trocar, and repetition of the operation eight days after. About sixteen months subseqnently, tapping in the epigastrium with a large trocar; retention of a large catheter for some time, and occasional injection of warm water. A month after the third operation the cyst was punctured in the right hypochondrium by a large trocar, and one or two large catheters retained, and attempts to wash out the sac occasionally made (Timothy O'B.).	3 pints by the first operation; 3½ pints by the second; 9 pints of brown fluid by the third; and 3 or 4 pints of similar bilious fluid by the fourth operation.	On account of pressure on the chest by the tumour the patient was unable to stoop or work. Great relief followed the first tapping. Being anxious to return to work, and declaring that "he felt no inconvenience whatever, and was as well as he had ever been," the patient was discharged 11 days after the second tapping, with a considerable fulness in the right hypochondrium. He was readmitted 16 months afterwards. The distension had gradually increased, and the respiration was very much interfered with. After the third tapping the catheter could not be reintroduced on a certain day on account of the slipping out of the little guide catheter, and the cyst was allowed to fill again. About three weeks afterwards the cyst ruptured into the lung, causing cough and fœtid expectoration. Attempts to wash out the cyst after the fourth tapping at first caused violent cough and dyspnœa. A subsequent attempt was followed by the evacuation of 15 ounces of cyst membranes. This was succeeded by great prostration, with vomiting, hiccup, and pain across the epigastric and hypochondriac regions. He gradually sank, and died 26 days after the last tapping. A large cavity containing a few shreds of lining membrane, and the remains of a thick partition occupied the centre of the liver. It communicated through a small opening in the diaphragm with the right lung, the whole of which was pneumonic, and the lower part full of pus. Behind the liver, in the lesser omentum, were two large cysts full of pus and disintegrated cysts, and the peritoneum in the neighbourhood was covered with lymph and pus.	Death from retention of the contents of cyst and extension into the lung, and peritonitis.	MacGallivray. Case xvi, op. cit., vol. x, p. 249, and vol. xii, p. 69.
92	M	29	Tumour of the right hypochondrium.	About 6 ounces of slightly opalescent	Excepting a little local urticaria and aching pain about one of the punctures no disturbance immediately followed any	Death from	Dr. Bradbury. Brit. Med.

in two places with a hollow pieces of hydatid insertion of the canulæ, for the temperature for the of the

			needle, and the use of an [illegible] Three days afterwards a repetition of the operation, one of the punctures being in the axillary line an inch above the last true rib. On the twelfth day two punctures were made, one in the epigastric region, and the other just behind the axillary line and above the tenth rib. On the 46th day the aspirator was again employed under chloroform, and afterwards two trocars with cannules were introduced through the hypochondrium, and a solution of carbolic acid thrown in several times during the operation. The cannules were left in the wounds, and the cyst was cleared by a feather shaft, and solution of carbolic acid thrown in from day to day. The lower tube came out of the wound on the 74th day, and was not replaced. No discharge had passed through it for some time (J. C.).	vesicles, were obtained by the [illegible] aspirator. 22 ounces of clear, hydatid fluid, were liberated by the cannules on the 46th day. On the 59th day the discharge was bile stained. On the 74th day 3 or 4 pints of suppurating hydatids were spontaneously discharged.	three following days, and the girth over the tumour after this operation was ½ inch less. On the 51st day there was [illegible] A free discharge occurred from the cyst some days later, and the pyrexia declined. On the 51st day (a fortnight after the last operation) inflammation of the base of the right lung set in, and 10 days afterwards the cyst communicated with a bronchial tube, and about half a pint of yellow frothy matter, seemingly coloured with bile, was expectorated. Three days later there was profuse discharge of bile-stained fluid from the lung. No more appeared for 6 days. It then returned, and the patient died apparently suffocated in the act of expectoring it. Two contiguous cysts occupied the right lobe of the liver. The larger communicated with the external opening, and through the diaphragm with a small cavity in the adherent base of the right lung into which a small bronchus opened. The right lung generally was fairly healthy. The second cyst, which was about 3 inches in diameter, did not communicate with the former one. It was hard, and full of bile-stained *debris* of hydatid membranes.	disease into the	
93	F	36	Large hydatid cyst of liver. Tapped in 1869, and several times with a fine trocar in 1873, and subsequently a large trocar was used, and the cavity washed out.	In 1869 148 ounces of fluid were drawn off. In 1873 the result of the use of the fine trocar is not mentioned, but 2 ounces of pus followed the use of the large trocar.	After the first puncture "she remained well for a time, and appeared to be cured." She again came under treatment 4 years afterwards with a swelling of the side. After the last operation with the fine trocars she had a rigor, and it was then that the large trocar was passed into the still prominent swelling. No details are given. The patient sank and died, and a hydatid cyst of the left lobe of the liver, capable and containing 2 pints, had perforated the diaphragm and right pleural sac.	Death from extension of the disease into the pleural sac.	Dr. Greenhow. Lancet, ii, 1873, p. 704.

No.	Sex.	Age.	Situation of the tumour and treatment.	Nature and quantity of the fluid withdrawn.	Progress.	Result.	Reference to Author.
94	F	39	Large hydatid tumour of the right lobe of liver, extending into the right pleura. Puncture and aspiration. Ten days afterwards puncture with a large trocar, withdrawal of the cannula, incision and insertion of the dressing forceps into the free opening. Subsequently the wound was kept freely open (Ellen M.).	Only 1 ounce of glairy, gelatinous fluid was obtained by the aspirator. The fluid was found to be too gelatinous to pass through the tube attached to the large trocar. About 3 ounces of glairy fluid, and a thick walled hydatid cyst were discharged through the incised opening in the side.	Two days after the aspiration the patient was greatly collapsed, and there was pain on the right side; during the next four days there were signs of severe peritonitis. On the 5th and 7th days she had severe rigors, followed on the last occasion by icterus and hectic. The jaundice and pain in the tumour increased. After the second operation the patient "did fairly well for some time." On the 16th day there was a large discharge of hydatids of all sizes with gelatinous fluid and pus, and during the next fortnight cyst *débris* came away on eight or nine occasions. On the 27th day there was pneumonia of the base of the right lung. This increased, and the patient died on the 38th day. There were several discharges of cysts during the last 10 days.	Death from extension into the pleura before treatment.	Dr. Andrews. Lancet, ii, 1875, p. 799.
95	F	30	A round, smooth, fluctuating tumour of the epigastrium. Puncture with a fine trocar, and immediately afterwards with a full sized one. 2 per cent. solution of carbolic acid was injected into the cyst, and a large tube tied in the wound. During the following ten days several pints of carbolic acid lotion were injected thrice a day through an elastic catheter passed into the cavity (Mrs. C.).	About 6 ounces of bilious, fœtid, purulent fluid, containing cholestrin, but no trace of echinococci passed by the fine trocar, and only 8 ounces more with several hydatid vesicles by the larger one. Whenever the cyst was injected large hydatid vesicles with fœtid, purulent fluid, came away.	Jaundice appeared 14 days before the tapping. It was preceded by acute pain, and soon followed by fever. There was intense jaundice and impending pneumonia at the time of the operation. While the treatment was being pursued the abdomen returned almost to its natural dimensions, and the jaundice in a great measure disappeared, but bile was still absent from the fæces. Aphthæ of the mouth appeared on the 4th day, rigors and high fever on the 5th, followed by prostration, and death on 11th day. The left lobe of the liver was occupied by an enormous cyst, containing 2 pints of very fœtid, thick, green fluid, mixed with large fragments of the parent cyst. The cavity communicated with the common bile-duct, which was obstructed by and distended with hydatid vesicles to the duodenal orifice. There was recent pneumonia, at some places	Death from pneumonia and retention of the fœtid cyst contents.	Murchison. Dis. of Liver, 1877, p. 112.

			liver and peritoneum. Aspiration of the largest swelling, the needle introduced three inches below ensiform cartilage, and half an inch to right of mesial line. On the 23rd day the aspirator was again used, but as the cannula became blocked a free opening was made, and a large perforated drainage tube fixed in the opening (Mary H.).	line, sp. gr. 1010, without hooklets, by the first aspiration; by the second 2 pints of opaque, yellowish fluid; and 9 pints more by the incision.	to 104°) and continued for the next three weeks. On the 23rd day the body girth was 4 inches more than it was before the first operation. The sac was not emptied by the last operation, but died 48 hours afterwards. There was no peritonitis; the external opening communicated with two large cysts in the liver, one of which was intensely inflamed. The lungs were encroached upon, and the lower parts, especially of the right, were collapsed.		Dis. of Liver, Case 27, p. 100.
97	M	17	Double pleurisy with effusion into the pleura, great enlargement of the liver. Fluctuation soon observed in the right hypochondrium. On the 12th day fluctuation more distinct, and tumour tending to point, Puncture with a small hypodermic syringe, and then with a larger trocar, and the cannula retained and plugged. On the 15th day incision into the tumour. Injection of carbolic acid water (1 to 100).	8 ounces of pus and small cysts were discharged by the first operation. 10 ounces of offensive pus and cysts by the incision, immediately, and next day 50 ounces more.	Relief followed by evacuations from the cyst, but even after the discharge on the 16th day the cyst still contained more of the offensive pus. During the next 6 days 56 ounces more were liberated, but at this time the breathing became more embarrassed, and the pulse rose to 140, and the patient sank on the 55th day after his admission, and 43 after the first operation. The liver was generally adherent to the front of the abdominal wall, to the diaphragm and the right kidney, and encroached on the right pleural cavity. The right lobe was almost entirely converted into a suppurating cyst, composed of thin discoloured liver tissue, from ¼ to ⅛ of an inch thick, excepting below, where there was a considerable thickness of liver tissue. This cavity contained several pints of pus and hydatid cysts. Both lungs were congested and adherent to the pleural walls by recent adhesions, and there wss effusion into the pleural sacs.	Death from previous pleurisy, and subsequent retention of the cyst contents.	Dr. Sieveking. Lancet, i, 1869, p. 637.
96	M	9	A large, fluctuating tumour of the right side, extending below the umbilicus. Tapping with a fine trocar. Repetition of the operation about three weeks afterwards. Forty-six days later tapping with a large trocar; insertion and retention of a large catheter (Charles B.).	3 or 4 pints of bilious-looking fluid, free from pus and echinococci by the first; a large quantity of similar fluid by the second; 50 ounces of stinking pus by the third operation.	There was much tenderness, and interference with the breathing before the first operation. The tumour refilled. After the second tapping an elastic catheter was inserted, but slipped out almost immediately, and owing to the retraction of the cyst could not be reintroduced. Before the third operation there was hectic and dyspnœa, the tumour projected much more in the epigastrium, which was very prominent and tympanitic. Great temporary relief followed the last operation, but he gradually sank and died 5 days afterwards. There was a single cyst of the liver, the walls of which and adjacent parts of the liver were in a state of gangrene.	Death from retention of putrid discharge.	MacGillivray, op. cit., Case 23, vol. xii, p. 71.

Reprinted from Vol. XII of 'St. Thomas's Hospital Reports.']

ON THE TREATMENT

OF

HYDATID TUMOURS OF THE LIVER.

By JOHN HARLEY, M.D.

Since publishing my last paper on this subject in the 'St. Thomas's Hospital Reports,'[1] only four cases of the disease have come under my care in the hospital. One, the subject of the present remarks; a second, was that of a woman in advanced life, who was admitted jaundiced and moribund into Christian Ward, with what from a superficial view (for she was too near death to allow of my making an examination) appeared to be ascites from malignant disease of the liver. The other two were cases in which the late Dr. Murchison had used simple puncture, one of these was in an extremely urgent condition from extension of the disease, and I transferred him at once to his care. As I am away from the hospital records, I cannot say what was the further progress of this case. The other case, in which eleven ounces of clear fluid were removed by the aspirator, continues under my care, and will probably require operative treatment at some future time.

The case narrated below serves very well to illustrate the treatment of these cases, which I have on former occasions advocated, namely, the establishment of a free opening into the cyst, whether suppuration has occurred or not; the complete evacuation of its contents; and the radical cure of the disease by

[1] Vol. viii, New Series.

contraction and obliteration of the remaining cavity. I believe that I have now arrived at a perfectly safe and satisfactory method of effecting this result. The following is in brief the treatment which I adopt. Thrust a trocar and canula (the larger the better, but not of less dimensions than a No. 12 catheter) into the most prominent part of the tumour, provided that this be, as usual, in one or other hypochondria, or not very distant from it. Assist the escape of such cysts or broken cyst-membrane as may be protruded by the tension of the parts, by a catheter wire formed into a little hook at the end; retain the canula by threads or tapes attached to holes in its shoulder, and well secured to the surface by strips of adhesive plaster; protect against injury from the edge of the canula by the insertion of an elastic catheter, loosely tied to the canula so as to allow of free play in the respiratory and bodily movements. For the next week nothing more need be done in the generality of cases, beyond the occasional removal of the catheter and the teasing out of such cysts as present themselves at the outer orifice of the canula. A week will suffice under these circumstances to effect adhesion between the cyst and the abdominal wall, if this have not already occurred, and it is not possible to predicate what the state of the case may have been before tapping. After the lapse of seven or eight days, when the patient usually begins to experience uneasiness from a return of the tension of the cyst, or from decomposition of its contents, or both, we should evacuate the contents of the cyst. The canula, which has now become loose by suppuration of the wound, should be removed *over* an elastic catheter previously introduced into the cyst; then there will be no difficulty in introducing a large catheter by its side, one always being retained within the cyst as a guide. Having thus provided a free passage into the cyst proceed to evacuate its contents. For this purpose, I have had made large (No. 20) elastic catheters, with a lateral eye about one inch long by one eighth of an inch wide. By means of an ordinary brass syringe with a fine nozzle, cyst-membrane is drawn into the eye of the catheter, and while tension is maintained it is withdrawn, and the cyst thus removed from the sac. By patient and continued repetition of this process, a very large sac may be more or less completely emptied in the course of two or three hours, cyst-membrane of any size and thickness

being easily removed. The lining membrane is not usually separated until the 9th or 12th day. When the sac is free from cyst-membrane, fluid injected by one catheter flows out by the other readily and without hindrance. In some cases a larger trocar and canula may be used, and then the sac may at once be more or less completely emptied by the use of a No. 20 catheter as above described; but, as a rule, there is no need of such haste.

As an aid in clearing away the cyst-membrane a weak solution (1 in 60) of carbolic acid may be freely injected provided that as much fluid passes out of the sac as is injected into it, and that no undue tension of the cyst occurs at any time from lack of a sufficient reflux. As an *aid* I have said carbolic acid may be so employed, but its use or that of creasote, as long as any cyst-membrane remains in the sac, will be necessary in order to prevent decomposition of the fluids (bile and serous liquid chiefly), which are rapidly passed out when the tension of the tumour is decidedly reduced. For some days it will be necessary to wash out the sac twice a day, a pint or more of the carbolic-acid water being used until it flows out colourless. After the cyst-membrane is discharged, once a day will suffice, and when we are satisfied that the lining membrane has come away, the discharges being sweet, there will be no further need of the injection of antiseptics. All catheters (sometimes I have inserted two or three small ones by the side of the largest in order to keep the passage to the sac sufficiently open) excepting the large one may now be removed. This, too, should be removed, washed and oiled, and then replaced, once a day. It should be passed to the furthest limits of the sac, and then before fixing the tapes a play of about an inch should be given to allow of the contraction of the cyst. As this occurs, the catheter may be occasionally shortened. It is necessary to pay attention to the directions just mentioned, for if the sinus be allowed to heal before the cyst has healed it may become dilated into an abscess. Such a result came under my notice two years ago. A young girl who had been under the care of my late colleague Dr. Murchison was sent out of the hospital before the sac had healed, and with directions to keep the piece of drainage-tube inserted, and present herself from time to time, failed

to observe these directions, and, as the sinus healed a few days after she discarded the drainage-tube, she considered herself well, but after an interval of a few weeks she presented herself suffering from pain in the hypochondrium and slight pyrexia. The sinus had partially opened a day or two before her readmission, but there was pain and tension in the seat of the original tumour, and on dilating the sinus the catheter passed a distance of eight inches, and communicated with a cavity which discharged about six ounces of pus. Although a fair amount of attention was subsequently paid to this case the healing was slow, and it was fully six months before it was completed. The patient, however, remained in good health during the process.

In the case given below, some of the more important matters relative to treatment are well illustrated, and it may be conceded that the injection of antiseptics was continued too long. This, however, was an error on the right side.

I am greatly indebted to my friend Dr. Ballance, who was then acting as my house physician, for his attention to this case.

Hydatid tumour of the liver of about eight years' duration; suppuration in consequence of a fall; puncture; complete evacuation of the contents of the cyst on the eighth and tenth days; maintenance of the opening; gradual contraction of the sac; healing by the seventieth day; radical cure.

July, 1881.—Catherine M—, æt. 44, a healthy woman of dark complexion, the mother of three children, one of whom, the youngest, aged five, is living. Her husband has been dead three years, and there has been no conception since the birth of the last child, but for the last seven or eight years she has had retching of clear bitter water, resembling the morning sickness of pregnancy, accompanied by "fearful pain in the left shoulder." In childhood she had scarlet fever, measles, and whooping-cough. Her only illness since was an attack of pneumonia, with which she was laid up a month.

The symptoms of her present illness began eight months ago. They were, pain in the lower part of the right chest, anorexia, especially on rising in the morning, irregular

action of the bowels with deficiency of bile, progressive swelling of the abdomen, with increase of the pain both in degree and duration. At the end of June, 1881, she fell downstairs, and thus brought her troubles to a climax. She was admitted into Christian Ward three weeks afterwards (on 20th July, 1881), having suffered severe pain and distress in the interim.

On admission her temperature was 102·8°, her expression anxious. She complained of vomiting, and of pain and swelling of the right side. A dry cough increased her distress, and the breathing was a little accelerated. The lower ribs of the right side were bulged forwards by a tense, dull, very obscurely fluctuating, extremely tender tumour, which invaded the right hypochondrium and epigastrium. Measurement of the side showed an increase of two inches; the lower edge of the liver corresponded to a line about one and a half above the umbilicus. There was complete dulness of the chest at the base of the right lung behind, with pneumonic crepitation and broncophony, except at the lowest part, where the breath sounds were absent. The pulse was 120.

Hydatid cyst of the liver pushing up and irritating the inferior lobe of the right lung was diagnosed, and as the symptoms had become urgent a No. 12 trocar was passed into the cyst through the right hypochondrium under the rib-margin, nearly in a line with the nipple, within four hours of her admission into the hospital.

A large number of cysts, some of which were moistened with pus, protruded. The canula was retained, the edge being guarded by the insertion of an elastic catheter, and for the next four days a large number of cysts were discharged with a moderate amount of sweet yellow pus, a hooked wire being occasionally used to aid their escape.

On the fourth day the canula was removed over an elastic catheter previously inserted, and a second catheter (No. 3) then passed into the sac by the side of the other. As but little discharge escaped through the catheters the canula was again slipped into the sac over one of them on the day following, and much cyst evacuated. The discharge for the next few days was rather scanty, and was becoming fœtid.

On the eighth day, therefore, the canula being again removed over a No. 5 elastic catheter, a No. 20 elastic

catheter was easily introduced by its side, and then by means of a fine-nozzled 4-oz. brass syringe, cyst-membrane was readily drawn through the wide eye of this large catheter, aspiration being sustained during the act and quantities of very large and thick cyst-membrane were drawn out of the wound every time the catheter was withdrawn. As the catheter could be readily passed by the side of the guiding one into the cyst this process was kept up for about three hours, and until nearly a quart of hydatid cyst, moistened with fœtid pus, was removed; an ounce or two of carbolic-acid water (1 to 20) was then injected and removed, the process being repeated until about a quart had been used and the fluid came away clear. The cyst being thus fairly emptied very great relief was experienced, and by daily repetition of the process for the next two days about as much more cyst-membrane, some very large, was removed, and this was accompanied by a discharge of yellow bile.

The cyst was now completely emptied, and for the next three weeks it was daily washed out with carbolic-acid water, and then, as there was some evidence of carbolic-acid poisoning, with a weak solution of chlorinated soda, the fluid readily flowing from one catheter as it was injected by the other.

On the thirty-eighth day the catheter passed a distance of eight inches, and the cyst held about five ounces of fluid without discomfort.

Fifteen days later the cyst was reduced to half its size, the discharge was normal pus and small in quantity. The larger tube was alone retained and shortened from time to time as the cyst contracted.

On the seventieth day after the primary insertion of the canula, the sinus had quite healed and the surrounding abdomen and rib margin was normal and bore deep pressure without inconvenience, resonant below, and normal liver dulness above.

She was discharged quite well on the eighty-eighth day.

On admission there were signs of pneumonia, but as the cyst was a large one and pushed the diaphragm upwards, it was not possible to accurately determine the amount. All her symptoms were relieved by the evacuation of the contents of the cyst, the temperature becoming normal except occasionally in the evening when it twice or thrice rose to 101°. On the

fourteenth day it attained 102·6°, and this was associated with the development of a little pneumonia with rust-coloured expectoration in the upper lobe of the right lung. A week later this had subsided and remained normal until the sixty-fourth day when it rose to 102·4°, as a result of a slight attack of quinsy.

At the time she left the hospital the lungs were quite healthy and she was in good condition with a healthy colour.

I saw her from time to time during the next six months and again in July of the present year, two years after the cyst was opened. From the time she left the hospital up to the present hour she has had excellent health without interruption; and being quite free from her old disabling sickness and pain, has led an active life of hard physical labour. On examination at this date (July 20th, 1883) I find the chest normally resonant, and the expansion and sounds of the right lung full and normal to its base. Owing to the chronic curvature of the bony ribs over the situation of the tumour, there is a slight increase ($\frac{3}{4}$ inch) in girth round this side as compared with the left, and there is a larger amount of resonance in the region of the liver than normal. The abdomen and right hypochondrium are very supple and bear free manipulation without any discomfort. No trace of tumour or induration can be felt. A large scar, nearly as large as the navel, is retracted close under the margin of the ribs in a vertical line with the right nipple.

In my former communications ('Medico-Chir. Trans.,' vol. xlix, and 'St. Thomas's Hosp. Rep.,' vol. viii, p. 3) I have reduced the literature of the subject into synoptical tables and have drawn some general conclusions from them. I am sorry that my time and opportunities do not allow me to do more on the present occasion than notice those communications which I have received through the courtesy of their authors.

In Mr. Lawson Tait's tables,[1] Nos. 22, 24, 28, 57, and 80, are cases of hepatotomy for hydatids of the liver. These all show the advantage of making a free opening—a practice which I have always advocated,—and there can be no doubt that abdominal section and hepatotomy will always be attended

[1] "An Account of 110 Consecutive Cases of Abdominal Section." Reprinted from the 'Med. Times and Gaz.,' Nov. 5th and 26th, 1881.

with better results than simple tapping or efforts to secure the discharge of the hydatids by an orifice too narrow for the purpose. In my opinion, a hydatid tumour should never be punctured unless the operator have determined to evacuate its contents within the eight or twelve days next ensuing, by some means or another.

The case which I have given above has proved to me how easily, by means of a wide-eyed catheter and a syringe, this may be effected. For cysts that can be safely reached by the trocar, abdominal section is therefore out of the question, and its adoption in an ordinary case may be compared with the action of the Scotch laird who, to get a bundle of sticks to boil his tea-kettle, is said to have cut down a tree.

Dr. Mortimer Balding [1] has given an account of four cases:

Case 1.—M—, æt. 45, an indistinctly fluctuating tumour of the right hypochondrium. A week before admission into Somerset Hospital, Cape Town, he began to suffer rigors and night sweats, and the tumour became tender. About four days after, a small puncture was made, and pus escaped in small quantity. The wound was closed. Four days later a puncture was again made with a large trocar, twenty-six ounces of pus with hydatid cysts drawn off, and the wound again closed. He was relieved at the time, but died within the year.

With such treatment such an event was to be expected.

Case 2.—F—, æt. 29. Tumour of the liver occupying the right hypochondrium. After an exploratory aspiration, the introduction of a large canula and trocar, release of forty-six ounces of offensive thick pus with hydatid cysts. The canula was retained, and the cavity washed with disinfecting fluid for the next four or five weeks, when contraction and healing took place. She was seen five years afterwards, and a radical cure was effected. I might consistently append my comment on Case I to this also—"With such treatment such an event was to be expected."

Case 3.—M—, æt. 35. A large fluctuating tumour of the right hypochondrium with slight jaundice. Puncture with a large

[1] 'Hydatid Disease of the Liver, its Diagnosis and Treatment. A Thesis for the Degree of M.D. Cantab.' London: Harrison and Sons.

trocar, retention of tube, and gradual enlargement of the opening by means of catheters. Discharge of large quantities of purulent débris of hydatid cysts; shortly afterwards eruption of the same fluid through the lung continuing for several weeks. The drainage-tube in the wound was opened only occasionally for the discharge of pus and the injection of antiseptics, for air was apt to be drawn into the lung through this channel, causing great pain. The discharges in both directions gradually decreased, and, eight months after the puncture, the radical cure was completed.

Suppurated hydatids of the liver, when they are near the diaphragm, perforate it, and very rapidly discharge their contents into the bronchia. This is one of the strongest arguments for a free opening—or, I would rather say, for the speedy emptying of the cyst through a sufficient opening by the means I have indicated above.

Case 4.—F—, æt. 36. Tumour of right hypochondrium. Simple puncture and removal of 148 ounces of fluid. Two years after, a return of her discomfort, and two years later still she again came under treatment.

During the next two months the tumour was punctured several times with various sized trocars, but on no occasion was there much fluid drawn off, and as the discharge did not prevent it the wounds rapidly closed. The last wound was enlarged by a bistoury and thirty ounces of offensive pus drawn off and the cavity washed out daily, but she died ten days afterwards. The sinus was found to pass upwards and backwards into an old hydatid cyst occupying the position of the lower lobe of the right lung, destroying the diaphragm and the greater part of the right lobe of the liver, the right lung being compressed and the heart pushed over to the left.

The result in this case may be taken as typical. If the operator had followed the treatment which I have so long advocated at the outset, the patient, I dare say, would have been alive at the present time. Simple tapping is a proceeding that gives nobody much trouble, although occasionally fatal it is rarely dangerous, it satisfies the diagnosis, gives immediate relief, and often lulls the patient into a feeling of security. Fortunately for the patient it often sets up purulent inflam-

mation in the sac, a condition which calls too loudly for relief to be neglected. But in those cases, or, at least, in most of them—my observation bids me say in all—where a cure seems to have been effected, the disease progresses insidiously just as it did at first, but sooner or later declares itself in a more extended form. Old hydated cysts, like the corms of the colchicum or the crocus, readily produce a new one by their side. I hold it therefore to be bad practice, and, on the evidence, unjustifiable practice, to approach a hydatid cyst with any other intention than that of completely emptying it and healing up the space that held it.

Dr. Jonas Jonassen, of Reykjavik, Iceland, has obligingly sent me through Dr. Magnusson, of Cambridge, his 'Doctor's Thesis on the Echinococcus Disease of Iceland.'[1] He gives an account of seventy-four cases, many of which are hydatids of the liver. If my knowledge of Icelandic had been sufficient for the purpose, or if I could have secured the services of an interpreter in time for this paper, I would have given a synopsis of these cases. Under the circumstances I am obliged to be content with calling attention to Dr. Jonassen's interesting treatise.

Postscript to Case 1, *p.* 306, *vol. viii, 'St. Thos. Hosp. Rep.'*—Shortly after leaving the hospital, in May, 1878, the patient married, and on 28th of June, 1883, she wrote to me in part as follows:—"In March last my husband died after a long illness. I have three little children. With regard to my health, I may just say that, with all the extra pressure upon both mind and body, I have not been laid aside even for a day. My restoration has been perfect."

[1] 'Ekinokoksygdommen, belyst ved Islandske Lægers erfaring.' Copenhagen, 1882.

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A CASE

OF SO-CALLED

ACTINOMYCOSIS OF THE LIVER.

BY

JOHN HARLEY, M.D.Lond., F.R.C.P., F.L.S.,

PHYSICIAN TO, AND LECTURER ON GENERAL ANATOMY AND PHYSIOLOGY AT ST. THOMAS'S HOSPITAL.

Read November 24th, 1885.

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Received November 10th—Read November 24th, 1885.

On October 1st, 1884, my friend Mr. J. Crossman, of the Wandsworth Road, London, sent Joseph Robert W— into the Arthur Ward of St. Thomas's Hospital.

The patient was thirty years old, and a joiner by occupation. He was very pallid, about five feet eight inches high, much emaciated, and weighed only seven stone. A very painful tumour, about the size of an orange, projected forwards from the left hypochondrium; the skin covering it was distended, shining, and pale; and the swelling was very painful to pressure. It was obviously connected with the left lobe of the liver, for it was limited above, below, and to the right by a hard and dull surface continuous with the liver, and it was strongly affected by the pulsations of the aorta.

The enlargement of the liver was chiefly confined to the left lobe. There was general slight impairment of chest

resonance, but the breath-sounds were fairly healthy, the only abnormality being a faint occasional crepitation at the left apex and clicking at the end of inspiration at the sides. There was neither cough nor expectoration; the heart-sounds were normal, and the impulse in the fifth space. The tongue was tender, and the epithelial covering transparent—a condition predisposing to aphtha, which, indeed, appeared very soon after and continued, with occasional recessions (from treatment), up to the time of his death. The rest of the alimentary canal remained healthy, but the digestive power was feeble.

He died ten weeks after admission into the hospital, his general condition undergoing very little change, and his weight varying only a few pounds; it attained its maximum, seven stone four pounds, about five days before his death. The temperature ranged usually, with great regularity, between 97° F. to 98° at 8 a.m., and 101° to 102° between 8 p.m. and midnight; on four occasions only the night temperature attained 103° to 103·6°.

During the last nine days of his life the temperature declined, and on the last three, instead of rising in the evening, as usual, it fell to 95°. Nocturnal (between 3 and 5 a.m.) sweating was for the first four months of his illness a troublesome symptom.

Apart from his hereditary tendencies, the patient's antecedents were good. He had had measles in childhood, but no other disease, and had led an industrious and temperate life.

The patient states that he was in perfect health seven months before his admission. A month later he came under my friend Mr. Crossman's care for an attack of acute inflammation, and he kindly furnishes me with the following information:

"*Family History.*—The father, æt. 70, has suffered for many years from asthma and chronic lung disease, and at times severe functional disease of the liver. The mother has also suffered from considerable derangement of the stomach and liver, from piles and epistaxis, one attack of the latter

being so severe as to require plugging of the anterior and posterior nares. Two sisters have been under my treatment, one dying at the age of twenty-seven years, after about six months' illness, of acute phthisis; and the other is now under occasional treatment for the same complaint, and the prognosis is extremely unfavorable. The two brothers I have not seen.

"The patient came under my care on February 23rd, 1884. He had returned from his work and was suffering acutely from 'severe pain in the bowels,' which had been preceded by shivering. There was neither vomiting nor nausea, and the temperature then, and for some days after, never exceeded 102·5° nor fell lower than 100·5°. Even when the patient lost most of the pain and fever the temperature never fell to the normal standard. During the first weeks of his illness there was an anxious expression of face; pain on moving in bed, and more or less pain over the abdomen. At one time a blister was applied over the left epigastric region (the part most complained of), and afforded relief. The base of the right lung from the first gave signs of pneumonia, and this continued for some days, and then slowly cleared up. The urine was normal in quantity and character. The liver area was normal; the heart weak but sounds healthy. In about eight or ten days his condition became chronic with intermissions and accessions of pain and feverishness. During most of the time the respirations were short and painful, accompanied with a hacking cough but with no serious expectoration. The patient always maintained a stooping posture in walking. There were no symptoms of jaundice, but a constant colourless condition of conjunctiva, much loss of flesh and great depression of spirits. After the first month there was improvement but no signs of permanent recovery, and in April, when a change was made into the country, the patient returned very little better. On May 5th, contrary to my advice, he recommenced work and continued it for several weeks. The day before he entered St. Thomas's I saw him and found for the

first time an abscess, tense and extremely painful, on the anterior surface of the liver. He was advised at once to proceed to the hospital for operation."

The swelling was characteristic of the disease. It was pallid, arose up suddenly from the parts beneath, and was surrounded by a uniformly firm base in the liver. These characters sufficiently distinguished it both from an ordinary abscess and from hydatid disease.

I incised it at once and freely, but was disappointed with the result, for not more than two ounces of pus and blood could be removed. It had a slightly offensive odour, and our house-surgeon, Mr. Makins, on introducing the finger, found that the floor of the abscess was just within the surface of the liver, which moved up and down with the diaphragm.

Drainage-tubes were inserted, and an opening maintained up to the time of his death. Great relief followed the operation, but the subsequent course showed plainly that we had to do with a lowly organised disease. The discharge was never free, and although the cavity was freely and frequently injected with aromatic antiseptics (eucalyptus and thymol) it was for a long time very offensive.

The painful edges of the wound were long in showing any disposition to granulate, and when they did so the granulations were poor and pale. Very little pus appeared upon the poultices; but a small teaspoonful of smooth, homogeneous, very thick, cream-coloured matter could at any time be extruded slowly by pressing firmly upon the indurated base of the abscess.

On the thirty-third day after admission a diffuse, painful, fluctuating tumour was discovered in the right loin. It was opened the following day, and about two ounces of offensive pus discharged; the twelfth rib, covered however by its periosteum, could be felt in the abscess cavity. Pus of the same character continued to be discharged freely for a few days, and the abscess then gradually contracted, but never completely healed.

About the time of the formations of this abscess he had a slight cough, with a little clear bronchial expectoration, and the nocturnal sweatings which had much subsided were again troublesome. On the evening of the fifty-ninth day the cough suddenly increased, and during the night he expectorated about sixteen ounces of rather offensive and slightly rusty muco-purulent matter. This was attended by signs of congestion (dulness, diminished breath-sounds, and crepitation) of the lower and hinder part of the right lung. Beyond the severe and distressing cough, there were no other symptoms. The expectoration ceased as suddenly as it appeared, and after twenty-four hours he was in his usual condition with scarcely any cough remaining.

But for the nature of the expectoration, one would have supposed that he had emptied some internal abscess by the lung. The general condition now improved a little, and once more the mouth became free of aphthæ (stomatitis fungosa—*oidium albicans* of the usual form).

The improvement, however, was only temporary. After signs of increasing weakness for a day or two the patient suddenly collapsed, and died on the seventieth day after his admission into the hospital.

Post-mortem Examination.—The body was pale and much emaciated, the abdomen not appreciably enlarged. The contour of the hypochondrium was but slightly raised, the prominency of the tumour having gradually subsided. A pale, imperfectly granulated surface, about the size of a florin, with a narrow cicatricial margin, and a central aperture admitting a No. 5 elastic catheter, were the remains of the original incision into the most prominent part of the tumour. Firm continuous pressure on the margins of the sinus caused the extrusion of a few drops of very thick creamy, homogeneous pus.

Another sinus existed in the right loin, and communicated with the old abscess cavity in that situation.

The peritoneal surface of the left lobe of the liver was

thickened and adherent to the abdominal wall in front, for an area of about two inches around the sinus, and above to the diaphragm and pericardium.

The sinus communicated with a cream-coloured, rounded, shreddy, boggy mass, the interstices of which were occupied by a thick creamy pus. The whole mass resembled a huge anthrax about the size of a large orange.

Pus could be squeezed out of any divided part, but it was for the most part retained in the shreddy interstices of the tumour.

The liver was enlarged, weighing 5 lb. 3½ oz.; its substance generally was quite normal. It stained black when soaked in 1 per cent. solution of osmic acid; the bile and fæcal matters were typically healthy in appearance. A number of globular masses of morbid deposit were scattered through the gland, two of them being nearly as large as the one which had pointed externally; several were of the size of Tangerine oranges; the smallest were aggregations of a few tubercles the size of hemp seeds. The smallest and youngest were co-extensive with the hepatic lobule, and they were almost as soft as brain substance. Where a dozen or more such tubercles were aggregated the intervening liver tissue was replaced by a coarse soft stroma, white and shreddy, but near the surface often discoloured by post-mortem staining. Sections of these smaller tumours presented an appearance exactly similar to that of caseous tubercle in red hepatised lung.

The larger masses were always spherical, and their central portions more or less softened; being somewhat confined by the surrounding liver, they bulged a little beyond it when they lay near the surface.

These tubercular masses were scattered throughout the liver, the larger and more advanced being in the thickest part of the gland, and here two of them, each nearly three inches in diameter, were separated by a band of liver barely a quarter of an inch thick.

The youngest of the morbid deposits were found in the thinner and marginal parts of the gland.

The disease was thus seen in all its stages from the invasion of a single lobule of the liver, to the large purulent mass which had been incised.

The liver-substance immediately surrounding both large and small masses was dark and congested, and this exaggerated what would have been otherwise a very sharp line of demarcation between the healthy and morbid structures.

The diaphragm was adherent to the surface of the liver by recent inflammatory action. A few scattered yellow tubercles the size of hemp-seeds pervaded both lungs.

The right lung weighed 1 lb. $14\frac{1}{4}$ oz., and by its base was adherent to the pericardium.

The left lung weighed 1 lb. $7\frac{1}{2}$ oz. Both lungs were œdematous.

The pericardium was the seat of a chronic inflammation; it was thickened and adherent both to the pleuræ and diaphragm—to the latter in the immediate neighbourhood of the incised mass; and here it was reddish as if sharing in a continuous inflammation. The cavity contained 25 ounces of serum, and both visceral and parietal layers were thickly covered with a shaggy lymph. The heart weighed $13\frac{1}{4}$ oz. and was quite healthy.

With the exception of the vermiform appendix, the intestines were healthy. The appendix was long and wide, and lay turned up along the attached part of the ascending colon. Here it was inflamed and adherent to the abdominal wall, which itself formed the limits of the lumbar abscess. I am doubtful whether there was any communication between them, there was certainly no trace of pus in the appendix, the summit of which contained a little soft fæcal matter.

The kidneys were rather large, weighing together 15 oz., but they were apparently normal in structure, as was the spleen ($9\frac{1}{2}$ oz.) and the rest of the organs.

Minute Examination of the Liver.—Sections preserved in spirit are extremely instructive and interesting. The morbid masses are distinguished by their paler, almost white colour, and a netted appearance (Pl. 4, fig. 1). In the smaller and younger masses the apertures of the network—*cavities,* as I will call them, are circular, average the one twenty-fifth of an inch in diameter, and are regularly placed, the intervals being usually equal to the width of the cavities. In sections of the older masses many of the cavities are larger, some the eighth of an inch broad, and are evidently formed by absorption of the partitions. Some of the cavities are elongated and more or less acutely elliptical or slit-like, sections, in fact, of bending tubes.

Many of the cavities appear as mere cup-shaped depressions, others are deep and winding; all but the smallest present secondary depressions or rounded ridges, sometimes faintly, sometimes strongly, marked; they also present a number of minute pin-hole apertures upon their walls, but sometimes the cavities communicate by wide openings. The stroma or framework of the morbid mass is composed of the thick walls of these cavities and their intercommunicating passages. It is a compact, dense, fibro-elastic tissue, yellowish white where it lines the cavities, but greyish and faintly diaphanous in the intermediate portion. This stroma forms everywhere a complete investment, being continued around the mass as a sinuous border, soon blending with the liver substance and streaking it as it does so with faintly marked concentric lines.

It is clear from this description that the framework of the morbid mass contains within its walls a system of rounded cavities freely communicating throughout by fine, and occasionally by large, passages; in brief, it is a close network of fine thick-walled tubes, presenting comparatively wide dilatations or cavities at frequent and pretty regular intervals;—a structure approaching that of ordinary erectile tissue.

The question at once arises, what is the origin and

what the relationship of this network of enormously thickened vessels?

Sections taken from any part of the liver show the hepatic canals (Pl. 4, fig. 1, *b*), and also the sublobular veins to be perfectly healthy, even when the former lie within half an inch of the main foci of the disease, and the latter ramify within its area. But the reverse is the case with the portal canals; both arteries and veins are everywhere enormously thickened, and the intervening connective tissue proportionately increased (Pl. 4, fig. 1, *c*). Further, these thickened vessels could be traced into direct continuity with the network of vessels which forms the stroma of the tubercular mass. It thus appears that the afferent vessels—the portal vein, and the hepatic artery, are those which are engaged in the morbid process; the hepatic vein escaping any implication.

Whatever share the lymphatics may have had originally in the morbid process, they appear to have no place in the dense, almost tendinous tissue in which the vessels are now embedded. The bile-ducts also appear to be obliterated. Of the two vessels, the portal vein and the hepatic artery, thus associated with the disease, it will doubtless be conceded that it is the artery which takes the principle share in the process. Yet it is not certain that any new vessels are formed; I do not think it is necessary to assume so, for the main bulk of the vascular stroma may be regarded as the confluent interlobular plexuses of the morbid areas. The cavities, however, have a different origin, these I regard as the thickened capsules of the invaded hepatic lobules—each of the smaller cavities representing an excavated lobule, its wall being formed of the hypertrophied connective tissue of the interlobular spaces, and perforated by the branches of the interlobular plexus, which naturally enter the lobule. Thus is formed a network of blood-vessels of an average diameter of the $\frac{1}{100}$th of an inch, communicating freely with little cavities continuous with them, measuring about the $\frac{1}{25}$th of an inch in diameter. As the disease advances to its purulent

stage these cavities may be enlarged by dissolution of the intervening walls.

Further proof of this view of the origin of these cavities is furnished by microscopical examination (see p. 11).

I proceed now to describe the contents of these cavities—these sites of the original hepatic lobules. Turning again to the sections preserved in spirit, and using a slight magnifier, it will be observed that these little spaces are partially filled (Pl. IV, fig. 2), each by a little yellow, glistening, rounded *granule* lying naked in the recess, or partially embedded in a little soft matter which is easily washed away by a drop or two of water. The larger cavities, those formed by confluence are usually occupied by aggregations of these granules, which often resemble in contour a microscopical raspberry.

These minute granules vary much in size, the smallest are scarcely visible to the naked eye, while the largest sometimes attain the $\frac{1}{10}$th of an inch in diameter; the majority are about the $\frac{1}{40}$th of an inch (Pl. IV, fig. 3).

Characters and Structure of the Granules.—As may be inferred from the above description, the granules lie loose in the cavities containing them, and they may be readily shaken or picked out of the cells ("cavities") which are exposed in the section. Availing myself of this fact, I have been able to collect and examine them thoroughly. They are of a straw-yellow colour to the naked eye, but under the microscope they are often stained of a deep brown colour; they are spherical, oval, pyriform, reniform, and even subangular in outline, and obviously composed of aggregations of smaller granules about $\frac{1}{600}$th of an inch in size. Each constituent granule has a smooth continuously curved surface, but the aggregation is convoluted like a nodule of hæmatite, and like many renal calculi they present sometimes one or two nipple-like elevations. Exposed to the air they turn of a rich brown colour on drying, they are quite solid and apparently quite homogeneous, and have an average sp. gr. of 1·25; they have the consistence

of soft cheese, being friable, and easily compressed by the microscopic covering glass; many, however, give indications of slight grittiness. They stain well and easily, both with watery and alcoholic solutions of the dyes, and they become dark in 1 per cent. solution of osmic acid. Treated successively with nitric acid and ammonia they give the xantho-proteid reaction. Thus treated and disintegrated a number of oil spherules are set free. Exposed to combustion, they shrink very much, and leave a small quantity of white ash, soluble in dilute HCl and giving when neutralised a precipitate with oxalate of ammonia.

It appears, therefore, that they are composed of a proteid substance associated with a little fat and calcic carbonate.

Microscopical Structure of the Morbid Deposit.—Sections of the morbid area showed that here the hepatic lobules were in some places completely occupied by leucocytes, and in others by leucocytes with the granules above described (Pl. VI, fig. 2). The interlobular spaces were sometimes obliterated by the coalescence of the lobules, and sometimes they formed very wide bands of nucleated connective tissue pervaded by dilated, and often varicose, thick-walled vessels, sometimes loaded with red corpuscles. Thus wide barren fields, the $\frac{1}{25}$th of an inch and sometimes more, composed wholly of leucocytes to the complete outcrowding of liver-cells and blood-vessels, were presented to the view (Pl. VI, fig. 2). The leucocytes were well formed—granular spherical corpuscles varying from the $\frac{1}{3500}$th to the $\frac{1}{2500}$th of an inch in diameter, the majority being the $\frac{1}{2300}$th. In the older tubercles these corpuscles occasionally presented degenerative changes, becoming clear and glistening, and staining imperfectly (Pl. VI, fig. 1, *a*).

The appearances described were in successful sections prettily varied by the *granules* (see Pl. V), which formed bold groups of islands in the general waste of leucocytes, for they are composed of a denser material, and present

in section a radiated structure like concrete crystals of calcic carbonate (Pl. V, VI).

The usually aggregate condition of these bodies is well seen in sections. The simple spherical granules of which the majority are composed vary in size from the $\frac{1}{800}$th to the $\frac{1}{500}$th of an inch, but in the progress of the disease do not long remain isolated. In section the larger composite granules have sometimes an angular outline flanked by rounded bastions (Pl. V, fig. 1).

The granules are embedded in and adherent to the surrounding leucocytes, but there does not appear to be any continuity of structure between them, for the granules readily fall out of the sections, and after rinsing in fluid present a very smooth surface. Still in fresh specimens the adhesion is tolerably firm. In the older tubercles, where the leucocytes have begun to soften, it is difficult to retain the granules in sections, and their place is usually occupied by a wide lumen.

Under a low power (× 120) sections of these simple or composite granules present a radiated structure, in some faintly indicated, in others very distinct. The centres of some are diaphanous, or even luminous, the lumen being circular (Pl. VI, fig. 1), or from pressure subangular. Some of these openings are the $\frac{1}{800}$th to the $\frac{1}{1000}$th of an inch. The centres of other granules are dense and prevent the passage of light. Usually, however, the centres are lighter than the rest of the granule, and present an irregularly netted appearance (Pl. VI, fig. 1), as if due to a fine scanty stroma, which stains more readily than the adjacent tissue. The radiations proceed from the central clear space, or the apparent nucleus, with regularity, as straight or occasionally very slightly curved lines, and terminate without alteration in the surface of the granule, and thus impinge upon the leucocytes which are adherent to it. Under high powers, and when every detail in the structure of the leucocyte is clearly defined, the radiated masses gain nothing in appearances. The radiations remain soft, glistening, and wanting in sharp outline.

The netted centre which I have described above as stroma is in some granules more clearly seen than in others (Pl. VI, fig. 1).

Twelve or more of these granules, some simple, some composite, are frequently seen forming patches or colonies occupying a considerable portion of the site of a lobule (Pl. VI, fig. 2). For a time they are separated by the intervening leucocytes; as, however, they enlarge and coalesce, the leucocytes undergo degeneration; they wither, and, if they do not pass into pus, become reduced to a diaphanous tissue, sprinkled with fine molecules, and difficult to stain (Pl. V, fig. 1).

Changes also occur in the granules themselves. As they grow older and larger they present a thick clear cortical portion, destitute of striation, which, commencing apparently upon its surface, may be occasionally seen stretching far away into the tissue formed by the degenerating leucocytes (Pl. V, fig. 2). The morbid deposit in the lobules of the lungs presented exactly the same features, but here the action was more limited, being confined to single lobules.

Pathology.—It would appear that the first step in the morbid process is the extrusion of leucocytes. Is it a mere arrest of them in the liver, or is the lymph tissue in this organ too active in generating them? Of these two suppositions, the former is perhaps nearer the truth, for we know that the liver, like the lungs, is constantly receiving large numbers of leucocytes, and as they do not pass out of the efferent vessels of these glands we must assume either that they are used up in the chemical processes going on in these glands, or that they are converted into red corpuscles. If the latter be the case, then it is easy to explain the plethora of leucocytes in the hepatic capillaries, by assuming a diminution of the oxydising processes—a diminution of arterial blood. The question suggest itself: Would partials ligature of the hepatic artery result in the development of tubercle in that gland?

Whatever may be the cause, a plethora of leucocytes

is one prominent fact, and, apart from any obstruction to the hepatic artery, we can understand how a plethora of these white corpuscles, by outcrowding the red, and standing between them and the liver-cells, would lead to a depression of the chemical action in the liver.

As an effect of the foregoing plethora and subsequent effusion of the leucocytes, the liver-cells wither and ultimately disappear, together with the intralobular plexus of blood-vessels. Severe congestion of the interlobular plexus is the result in these areas at first; then follows, with increasing obstruction, dilatation and thickening of these vessels; and when the obstruction in the lobules is complete, stasis and, perhaps under the attendant irritation, plugging. In a large branch of the portal vein I detected an old clot sending branches far and wide into the small lateral vessels. Under the microscope this shrivelled clot was seen to be spangled with colourless crystals of calcic carbonate in spherical radiated masses, and in aggregated prisms.

In marginal sections of the diseased liver the smallest arteries are seen to be early affected. Leucocytes invade their walls and stand in single and double file around them; while others are stationed between the rows of liver-cells.

If the view which I have taken of the formation of the cavities of the stroma be the true one, it follows that the granules are formed in the interior of the lobules. When the leucocytic invasion of these is complete the blood current is of course entirely cut off, and the central parts of the lobule, being farthest removed from nutrition, show the first indications of degenerative change.

The deposit of a little calcic carbonate in the nucleus of a leucocyte may be the starting-point of the granule, its subsequent development being due to the extension of the calcareous deposit into the surrounding tissue, the leucocytic surrounding furnishing nutrition to the growing granule just as the mucous membrane supports the growth of a urinary or biliary calculus.

Whatever the morbid action may be, there can be no doubt, I think, that it originates in the lobule, for it is here that its effects are most obvious, while they are at the same time farthest removed from the first stages.

When these tubercular masses soften down, the pus is of course wholly contained in the vessels of the stroma. In the early stages the vessels, for the most part at least, remain pervious and partially filled with leucocytes, escaped, we may assume, from the lobules.

In the later stages they are filled with pus, and the difficulty of evacuating this is explained by the fact that in every cavity there is a granule, and sometimes in the apertures of that cavity a corresponding number of nipple-like projections from the granule: the smallest and simplest of these granules forming therefore a great, and the larger and more complex ones a complete, obstruction to the outward flow of pus.

Having now finished my history of the case, I pass to the consideration of a question of great interest in reference to the disease which I have described.

Those who are acquainted with the history of *actinomycosis*, and have heard my story and looked at my illustrations, will be ready to say, "It is a genuine and typical case of actinomycosis."

I am bound to admit that it agrees in many particulars with most of the typical cases of this disease which have been recorded, and my figures correspond exactly with those of Lebert,[1] Israel,[2] and others, and yet I am perfectly satisfied, and hope to prove to the Society, that there is no fungus whatever necessarily associated with my case. If this be so, then much if not all of the so-called actinomycosis disease must be relegated to its old, and, as I believe, its proper place, namely, "tubercle."

There can be no doubt then that we have under consideration an example of what has been described and illustrated by several authors as actinomycosis, and it is

[1] Traité d'anatomie pathologique,' Atlas; Tome i, pl. ii, fig. 16. Paris, 1857

[2] 'Archiv für path. Anat. und Physiol.,' Virchow, Bd. 74, 1878, Taf. ii, iii, iv.

necessary that I should state the facts which lead me to reject the fungus theory of the production of the disease.

It will be conceded that the present case furnishes a complete illustration of the disease from its first origin as a few escaped leucocytes in the centre of a lobule of the liver, to the ripe, purulent mass which projected externally. If the disease be due to a fungus, the fungus is here accessible to our observation and readily capable of demonstration. Simpler still, the fungus is confined to the granules, and it is these,[1] therefore, to which I must invite attention.

These granules may be regarded as typical examples of caseous degeneration of tubercular deposit.

I have stated that they are composed of a solid albuminous matter containing a little fat and calcic carbonate. The inorganic matter has been very long recognised as a constituent of tubercular nodules, and when it is in sufficient abundance to make them gritty, there is no denying its presence. But I am not aware that the advocates of the fungus origin of this disease will allow that any portion of the radiation in such a case as I have described is due to crystalline structure. They regard the rayed appearance as being due to the club-shaped asci of the fungus. In the present case nothing is easier than to disprove this view. If a section of a granule, or an aggregation of them, be selected for the boldness and distinction of its rayed appearance, and treated with strong acetic acid, while it is observed under the microscope, the radiations will melt away rapidly and, except perhaps in an old granule here and there, completely disappear, thus proving that they are due to crystalline matter soluble in the acid. It is in fact a delicate impregnation of an albuminous and fatty basis with calcic carbonate, which, like the organic basis of bone, may be removed without affecting the integrity of the matrix in which it is deposited.

[1] A large number of these isolated granules were exhibited to the Society.

This simple test is decisive, for if any fungus were present its finest portions would be brought out conspicuously in a specimen cleared by strong acetic acid.

Granules or their sections may be rendered perfectly transparent and subsequently disintegrated by means of acetic or the mineral acids, by caustic potash and ammonia, and when examined in this state by the highest powers ($\times \frac{1}{1200}$) they have failed to furnish me with the faintest trace of fungoid growth.[1]

Turning now to the physical conditions of the fungus, let us see what presumption these afford of the presence of a fungus. First, as to its position in the body. We find it in a flourishing condition, according to the descriptions, in the very centre of the morbid mass, where it is bathed in carbonic acid, and shut off from oxygen—a condition, as far as we know, incapable of supporting the growth of a fungus, which more than all other vegetables wants a free access of oxygen.

Again, the granule is not a mere mouldy mass like a bit of mouldy cheese, with its cavities, cracks, upheavals, and erosions, but a compact solid body with a smooth surface like a nodule of hæmatite. Cut it which ever way we will, we fail to recognise sections of the filaments or asci, which, if any such existed, would be, according to the measurements given of them, as plainly visible as the cross sections of fibres in a medullated nerve-bundle. The outer ends of asci are represented as not being all on the same level at the circumference of the actinomycosis mass, but my granules give no indication of such irregularity; they have, as I have said, a smooth and rounded surface.

Having examined the youngest and oldest of the isolated granules with the same result, I have explored a large quantity of debris, obtained by washing out the cells of the stroma with spirit.

This debris was composed (*a*) of granules; (*b*) of whiter

[1] See Appendix.

and lighter flocculent masses of leucocytes, in which the granules were embedded, and (*c*) a very small heavier residue composed of crystals. No trace of fungus was found in the lighter portions of the debris. The crystals were very minute, none more than the $\frac{1}{300}$th of an inch in size, and as they all dissolved in acetic acid with escape of bubbles of gas, I assume that they were all calcic carbonate ; a few were thick and rhomboidal like Iceland spar, a few others were smooth, spherical, or elliptical masses, the majority were clusters of a few coarse or many fine prisms. Some of the latter were beautiful rosettes, and when treated with acetic acid they separated into their constituent prisms, which had a strong resemblance, on account of their clavate form, to the conidia or asci of the actinomyces.[1] Sometimes two crystals were united, causing a forked appearance, which gave a still stronger resemblance. Soon, however, they melted in the acetic acid and totally disappeared. All these crystals were bright and colourless.

Scanning the field, on one occasion, with a very high power and a too thick covering glass, I caused it to slide as I was passing over some thin plates of cholesterin, when all at once the looked-for fungus, as I thought, appeared. Everywhere in the field long distinct filaments with expanded ends lay in bundles, and on all sides arborescent and feathery forms.

I mention this because, if a similar displacement had occurred in a fragment of cholesterin overlying one of the radiated masses, its meaning could only have been interpreted by the use of a solvent, of which there are so few for cholesterin.

Are we now to assume from this case that fungi are secondary and therefore non-essential developments in the cases of actinomycosis which are recorded. This, I think, would not be assuming too much. Fungi may spring up anywhere in the body when there is a free surface and a supply of oxygen, or in any fluid of the body, and there

[1] Israel, 'Virchow's Archiv,' 1878, t. iii, fig. 5.

is perhaps no more likely place than the sinus of an old abscess—nay, more, the surface of the granules themselves when they are thrown out into the sinuses may become clothed with fungi. A patient of mine died of phthisis many years ago in Kings' College Hospital, and at the post-mortem examination two of the papillæ of one kidney were found ulcerated; on examination I found the *Oidium albicans* luxuriantly developed for some distance along the straight tubules. But the conditions in such cases, as I have just mentioned, are very different from those of the so-called actinomycosis, in which the fungus is assumed to develop in a solid mass without disturbing it.

The striations which I have described and figured are, I maintain, nothing more than the earliest indications of that calcareous and fatty degeneration to which caseous tubercular deposits are so liable, and have no more connection with fungoid growth than a gall-stone has.

Appendix.

On the occasion of the reading of this paper my late Demonstrator of Physiology, Dr. Theodore Acland, who has taken a most laudable interest in this case, exhibited some specimens of mycelium obtained from it which he observed only two or three days previously when he was looking for bacilli. After the lapse of a year from the death of the patient, I naturally concluded that the fungus was a post-mortem development. Nevertheless, I have thought it my duty to reinvestigate the matter. Knowing how prone such matters as caseous tubercle are to fungous invasion, I was careful in making my original investigations to select the smallest and youngest of the tubercular masses, and to avoid those which had any communication with the external sinus, which had existed for many weeks and was frequently injected with fluids from without. In these, as I have stated, I have failed to detect any trace of a fungus.

In renewing my search the only material left to me was the museum specimen and the slice which is represented in Pl. IV. This includes the ripest portion of the disease and that which lay in contact and continuity with the incised mass, and also some of the youngest deposits as seen at *d*, Pl. IV, fig. 1. The specimen had been kept immersed in methylated spirit in a glass dish, covered loosely by a plate of glass, and it had been drained and exposed upon a glass plate several times for the purpose of examination and delineation. It is this portion of the liver which I have examined. I took the granules promiscuously, removing some from their natural position in the cells of the stroma, and collecting others which had fallen out into the preservative fluid. They were stained and mounted by the most approved methods for demonstrating micro-organisms.

In this way I have examined great numbers of these granules, and the result is that in a very few I have found traces of an extremely fine mycelium-like structure, but none of the club-shaped asci which are regarded as characteristic of the *Actinomyces bovis*.

Now, under the circumstances it will be conceded, I think, that the complete absence of fungoid growth would have been more remarkable than its presence, and this renewed examination has confirmed me in my former opinion that the fungus is not of the essence of the disease, but merely an occasional and accidental associate. With due deference to those who regard the fungus as the essence of the disease, I would ask them, as opportunities occur, to direct their attention to those portions of the diseased structures which have no communication with the surfaces of the body, and to the very earliest developments of the morbid action, and by this means exclude the question of accidental and secondary contamination.

The case above narrated is, I believe, the first of the kind which has been noticed in this country, and it is certainly not a common form of disease. I have regarded it from the first as an example of tubercular disease from

which the liver is so remarkably free; and the close examination which I have given the case confirms me in this view. (*May*, 1886.)

(For a report of the discussion on this paper, see 'Proceedings of the Royal Medical and Chirurgical Society,' New Series, vol. ii, p. 20.

DESCRIPTION OF PLATES IV, V, AND VI.

(A Case of so-called Actinomycosis of the Liver. By JOHN HARLEY, M.D.)

PLATE IV.

Fig. 1.—Section of the liver as it appeared in methylated spirit (natural size).

(*a*) One of the principal masses.
(*b*) Hepatic veins.
(*c*) Portal canals; vessels much thickened.
(*d*) Youngest deposits.

Fig. 2.—A portion of (*a*) Fig. 1, showing the cavities, some containing granules. × 3.

Fig. 3.—A heap of isolated granules. × 2.

PLATE V.

Figs. 1 and 2.—Radiate granules, surrounded by leucocytes. × 60.

PLATE VI.

Fig. 1.—A minute composite, radiate granule, showing variations in the central parts; in one a circular lumen, in others a nuclear matter, and in the largest a netted stroma. This granule is surrounded by leucocytes, some of which (*b*) are partially, and the rest (*a*) wholly, degenerated. × 150.

Fig. 2.—Three lobules invaded by leucocytes (*a*, *a*), interspersed with radiate granules, darker, and separated by thick walls of fibrous tissue, containing thick-walled blood-vessels. × 12.

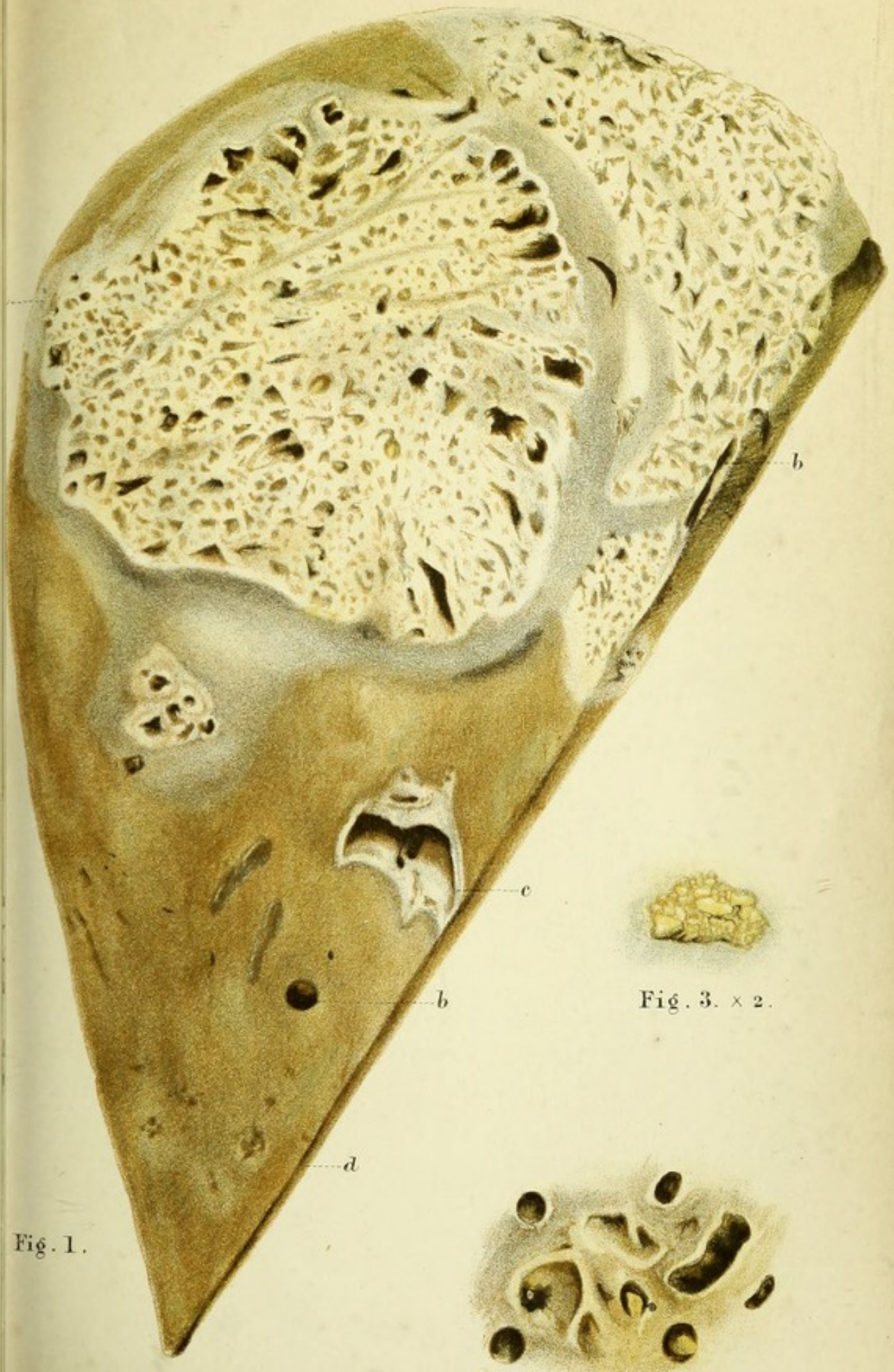

Fig. 1.

Fig. 3. × 2.

Fig. 2. × 3.

S. M. Harley ad. nat. del. Mintern Bros. Chromo lith.

Fig. 1.

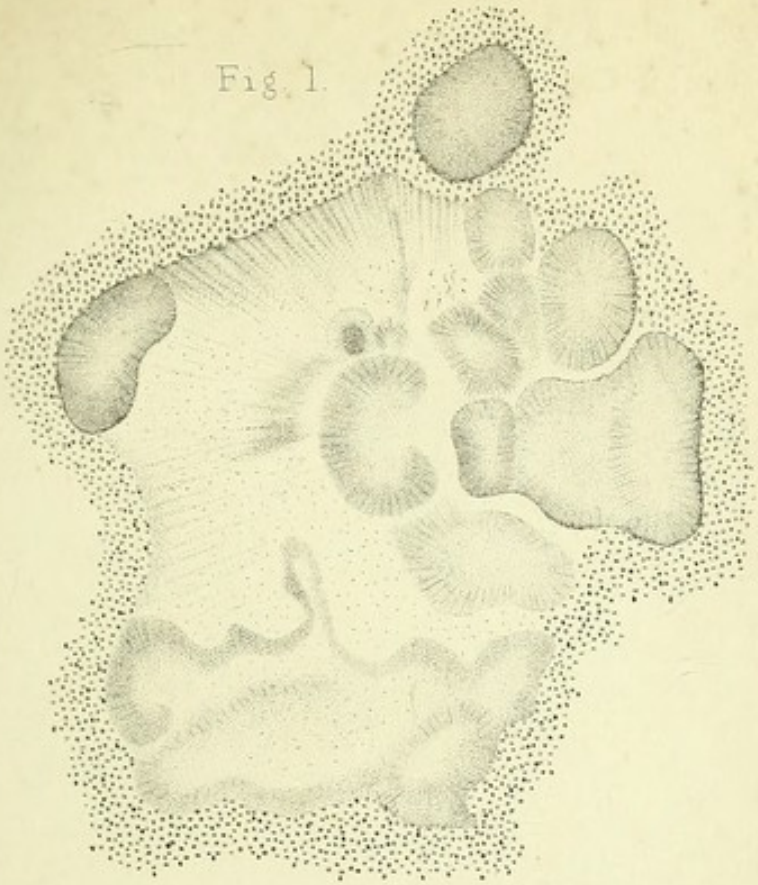

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Fig. 2.

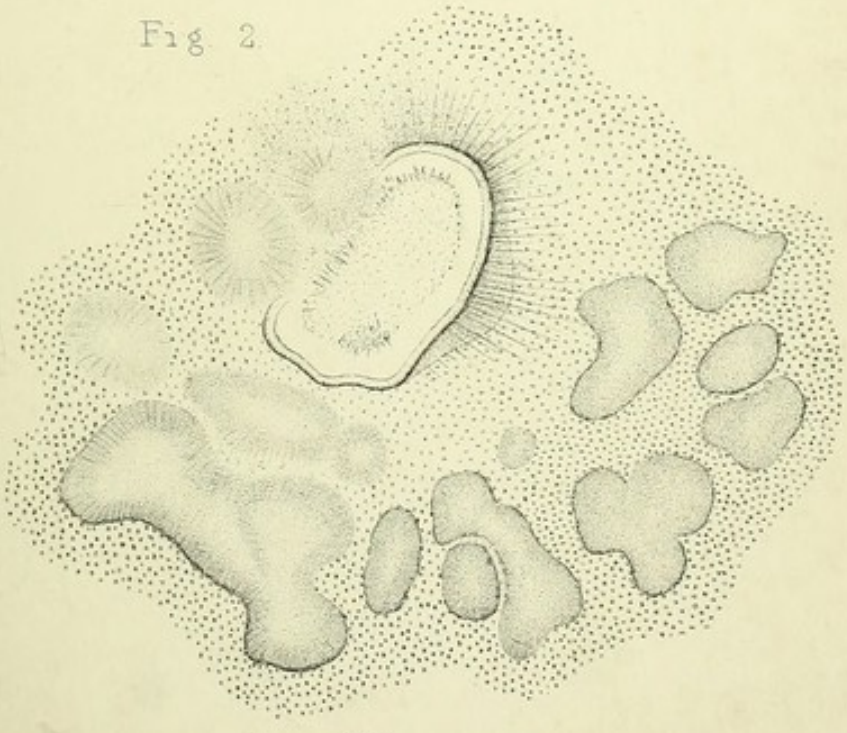

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Fig. 1.

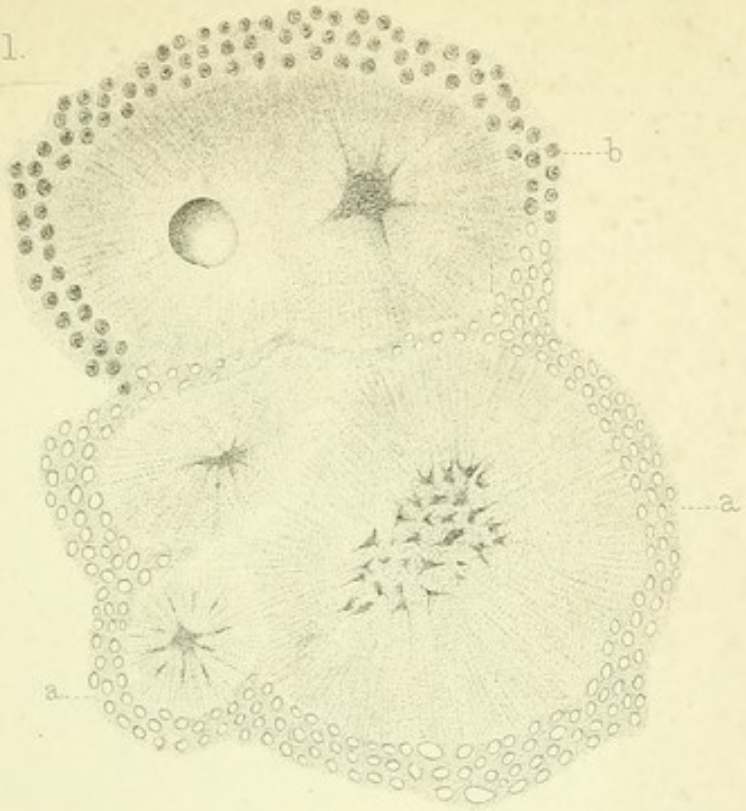

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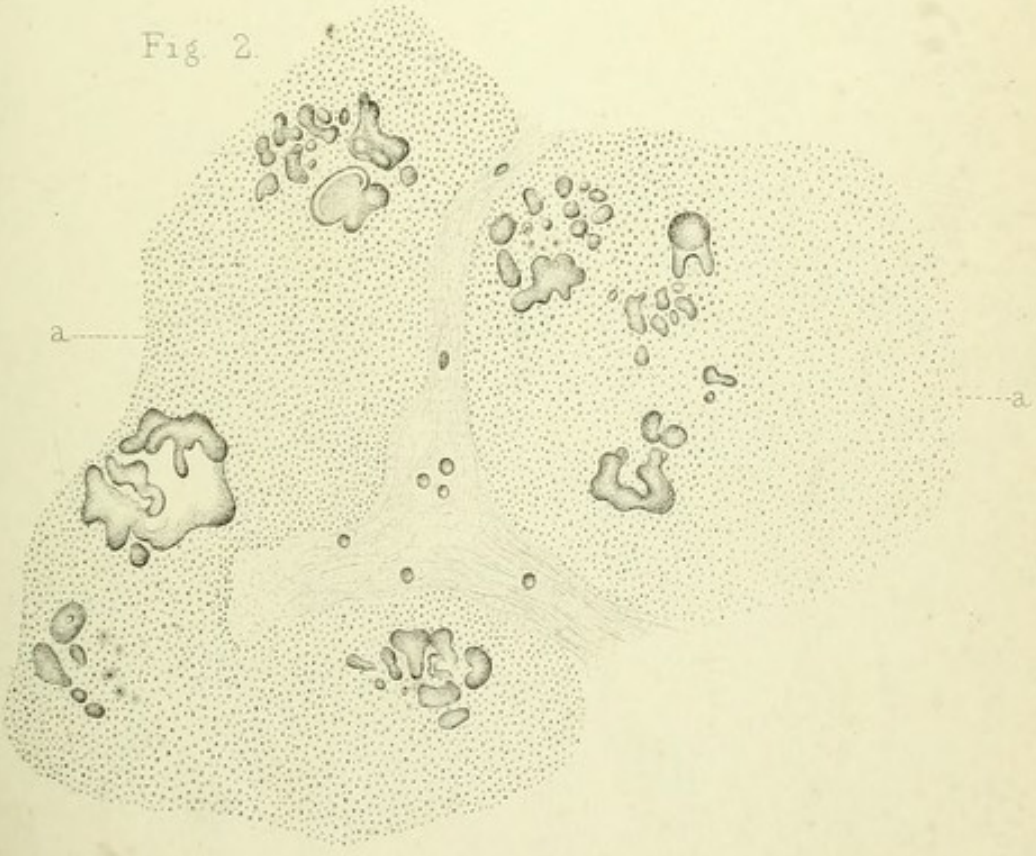
Fig. 2.



X 12

THE PATHOLOGY OF MYXŒDEMA

AS

ILLUSTRATED IN A TYPICAL CASE.

BY

JOHN HARLEY, M.D. Lond., F.R.C.P.,
LECTURER ON GENERAL ANATOMY AND PHYSIOLOGY AND PHYSICIAN TO ST. THOMAS'S HOSPITAL.

Read April 8th, 1884.

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1884.

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JOHN HARLEY, M.D. Lond., F.R.C.P.,

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(Received February 12th—Read April 8th, 1884.)

In his paper on this subject, published in the sixty-first volume of the 'Transactions' of this Society, Dr. Ord has given faithful reproductions of two photographs of Harriet Brown, one taken at the age of twenty-one when in a state of health, and the other at the age of twenty-seven when the subject of fully-developed myxœdema. She came under my care about three years before she was brought under the notice of this Society in 1877, and continued so up to the time of her death in 1881, and was regarded at St. Thomas's as a typical example of myxœdema. As I am now able to give a complete account of her case, I think it will prove interesting as a supplement to Dr. Ord's paper, and as an aid in the elucidation of this morbid condition.

At the age of twenty-one H. B— was a bright, active, slender woman, about 5 ft. 3 in. in height, and weighing

between eight and nine stone, of fair skin and dark hair. She had always enjoyed good health, there was no remembrance of any particular disorder in infancy, and she never had scarlet fever. Her general appearance at this time is given in Pl. vii, fig. 1, vol. lxi of the 'Transactions.'

Her parents, a sister, and two brothers are still alive, strong, and healthy. Her second and last child (who is now a bright, lively, spare, and healthy little girl) was born in 1871, at which time the patient was twenty-six years old.

The disease undoubtedly had its origin at this puerperal period.[1] The labour was not a good one, and recovery was protracted and imperfect. A year afterwards the myxœdema was fully developed, as will be seen in fig. 2 of the plate just referred to.

Three years later she came under my notice, and for the next five years, *i.e.* up to 1879, there was no noteworthy change in her condition. She merely complained of debility. The integument of the face was thickened, the eyelids puffy, and the bright crimson injection of the fair cheeks contrasted with the very dark brown hair. Excepting an occasional slight pitting over the tibiæ, and a little puffiness of the ankles, there was no thickening or œdema of the legs. All the functions were normally performed. The urine was frequently examined, and always found of rather low specific gravity and free from albumen. The pelvic and abdominal viscera were healthy.

The only defects discernible were deficient expansion of the chest walls with slightly prolonged expiration and impaired resonance—the usual indications of chronic pleuritic adhesions—and a rather feeble ventricular contraction. The pulse was correspondingly weak, but otherwise quite normal.

She took chalybeate tonics with advantage, and was always able to attend to her household duties.

Becoming a little weaker she was admitted into Christian Ward on 2nd September, 1879, and remained

[1] See p. 194.

in the hospital fourteen weeks. She said that three weeks previously she was suddenly taken with giddiness and weakness in the left side, and she should have fallen but for help.

The following was her condition at this time :—She was fairly well nourished, complained of increased weakness, of pain in the back of the head and down the back, of impairment of memory and of vision of the left eye. Excepting a little weakness of the left leg there was no special diminution of muscular power, nor was there any sign of nerve lesion or disorder. There was a little cough at night, a few bronchitic râles in the right lung, and a little crackling and diminished resonance at the left base posteriorly. The apex beat of the heart was neither visible nor palpable, but the position and sounds were normal; the pulse 72, weak. Both flanks were rather dull, but the abdomen was otherwise normal. There was slight œdema over the shins, and the feet became a little puffy on standing. The urine was normal and averaged about forty-eight ounces.

From the 9th to the 12th September the urine decreased to fourteen, twelve, and four ounces in the twenty-four hours, but continued normal; the puffiness of the face and œdema of the feet increased, the skin was moist, pulse 68, unchanged, temp. 96°, resp. 20. She was depressed, complained of great pain in the back, and had frequent nausea.

On 13th September and subsequently, the normal amount of urine, sp. gr. 1013 to 1017, was passed, but there was no improvement in the symptoms.

On the 15th she vomited, but the bowels continued regular, as was always the case.

During the rest of this month and the whole of the next she grew worse, and was wholly confined to bed, being occasionally restless, fretting over imaginary troubles, and getting out of bed, and in doing so on one occasion she fell and bruised herself. She was alternately drowsy and restless with slight delirium, muttering to herself and

being frequently under the delusion that someone was waiting for her. She complained of sick headache; the pulse was small and weak, but not accelerated; the heart sounds very feeble and hardly to be heard; the temperature from 1° to 3° subnormal (see below). The urine varied from twenty to thirty-six ounces, sp. gr. 1007 to 1017, occasionally depositing a slight amount of lithates; on two or three occasions it was darker coloured and deposited phosphates. The amount of urea excreted at intervals was as follows:

Oct. 30	... 24 hours	... 140·5 grs.		
Nov. 6	... „	... 90·5 „	...	Sp. gr. of urine 1013
„ 8	... „	... 101 „		
„ 13	... „	... 196·6 „	...	36 ounces of urine
„ 18	... „	... 66·9 „	...	34 „ „

The average for the five days is 119·1 grains, being a reduction to about half the amount excreted by a healthy individual of her sex, size, and weight.

During the time she remained in bed and for some time after, the temperature was carefully recorded night and morning at the same hours; it was constantly subnormal from 1° to 3°.

Average for the 1st five days,	Aug. 31 to Sept. 5	96·2° Fahr.	
„ 2nd „	Sept. 6 to „ 10	96·2° „	
„ 3rd „	„ 11 to „ 15	97·4° „	
„ 4th „	„ 16 to „ 20	96·9° „	
„ 5th „	„ 21 to „ 25	96·7° „	
„ 6th „	„ 26 to „ 30	96·3° „	
„ 7th „	Oct. 1 to Oct. 5	95·9° „	Constantly in bed.
„ 8th „	„ 6 to „ 10	96·3° „	
„ 9th „	„ 11 to „ 15	96·7° „	
„ 10th „	„ 16 to „ 20	95·6° „	
„ 11th „	„ 21 to „ 25	96·6° „	
„ 12th „	„ 26 to „ 30	95·7° „	
„ 13th „	„ 31 to Nov. 4	96·3° „	
„ 14th „	Nov. 5 to „ 9	96·6° „	
„ 15th „	„ 10 to „ 14	95·8° „	Began to sit up in the afternoon.
„ 16th „	„ 15 to „ 19	96·6° „	
„ 17th „	„ 20 to „ 24	97·7° „	

The highest temperature recorded is 97·7°, and the difference between this and the lowest was only 2°.

On the 7th November she was nearly relieved of the cerebral symptoms, but she still felt weak and giddy, and had a little pain in her limbs; she walked slowly, moving the limbs equally. The pulse standing was 92 and regular, but the slightest pressure effaced it.

On the 15th of the same month she had returned very nearly to her usual state, eating and sleeping well. Five days before she left the hospital (December 12th) the catamenia reappeared after an absence of a year.

After this illness there was a marked declension of strength, but she still got up early in the morning and attended to her household duties, her condition remaining very uniform for the next two years nearly.

On the 30th September, 1881, she was again admitted into Christian Ward under my care, and died five days afterwards. She complained of loss of power in the left side so that she could not walk without help; she had a troublesome cough and a little bronchial expectoration. Her appearance and manner were unchanged, except that the expression was heavier and the speech thicker and more laboured. The skin was dry and harsh, that of the chest being rough with raised papillæ. The respiration was almost entirely abdominal, 24. The breath sounds were normal on the right side excepting at the apex and down the back to the side of the vertebræ; here it was rather harsh and the expiration was prolonged. The left chest was dullish everywhere; there was an increase of vocal fremitus and bronchophony, and the breath sounds were rather tubular. The apex beat of the heart could not be either seen or felt, the first sound was inaudible, the second clear and sharp; pulse regular, small, and feeble, 72. Tongue clear and moist, appetite defective, bowels regular, the abdomen normal, the urine normal in quantity, sp. gr. 1020, free from albumin. The catamenia had been absent three months.

Left to herself she lapsed into the drowsy, semi-delirious

state above described as her condition when in the hospital nearly two years previously. The highest temperature recorded was 97·4°, but the four last days of her life it was only 94°. There was retention of urine the second day after admission. The day before her death she could be roused, and passed water without assistance. She died of asthenia.

The post-mortem examination was made by Dr. Gulliver. The body was well nourished, the skin singularly fair, like alabaster or œdematous tissue, but quite free from œdema excepting around the ankles, where pressure caused slight pitting. There was a moderate amount of pure white adipose tissue. The peritoneum contained a pint and a half of clear serum ; here and there there were a few old fibrous adhesions, but about the uterus and ovaries they were strong and general.

The *liver* weighed 2 lb. 13½ oz. On the surface a few scattered yellow dots—not raised—were observable, but the structure was normal.

The *kidneys* weighed together 9½ oz. ; they were lobulated, slightly elongated, and narrow. The section was unusually firm and glistening, the cortex injected, the capsule stripped off too easily, and the arteries were thickened. Otherwise the organs were quite healthy.

The *uterus* was nearly twice its normal size, but otherwise healthy.

The *spleen, intestines,* and the rest of the pelvic and abdominal viscera were normal.

The *tongue* was unusually firm and contracted ; the *thyroid gland* reduced to two little yellowish-white masses, together about the size of the last joint of the little finger. The *chest* was narrow and the muscles pale and stringy. The *pericardium* was distended with clear straw-coloured serum ; there was no evidence of inflammatory action.

The *heart* weighed 7½ oz., it was firmly contracted and empty, the muscle was healthy, and the valves also, and competent ; there were a few patches of commencing atheroma at the root of the aorta.

The *right pleural cavity* contained half a pint of clear serum, the apex of the *right lung* (which weighed 1 lb. 1½ oz.) was firmly fixed by old adhesions; a cicatricial depression corresponded to the adhesion, and an inch internal to this there was an old nodular thickening with here and there a little cretaceous deposit. The posterior border of the lung was devoid of air and in a state of fibrous degeneration.

The *left lung* weighed 1 lb.; it was everywhere firmly adherent to the chest, and behind and at the sides the pleura was converted into a thick opaque fibrous membrane, and the lung could only be separated by dissection or laceration. The whole of the lung was in a state of fibrous degeneration, being very tough, completely free from air, and sank in water. Sections presented a streaky appearance due to the paler bronchial tubes and an increase of connective tissue around them. A teaspoonful of creamy odourless pus oozed from one of the divided bronchia, and the same amount from the trachea as it was divided opposite the supra-sternal notch.

The thoracic gangliated cords were deeply implicated in the adherent and degenerated pleuræ, and on the left side the ganglia could not be satisfactorily distinguished.

My colleague, Dr. Hadden, undertook to examine the *cervical sympathetic* and some other of the tissues. The following is his report:—"There is no alteration which can be pronounced abnormal in the cervical sympathetic; some of the ganglion cells appeared unusually large and pigmented, but on comparison with normal specimens, I could not satisfy myself that there was much variation from the healthy condition. But on comparing these ganglia with those of another case which I have recently examined, the similarity of the changes in the two cases is very striking. The lesion consists mainly in a sclerosis causing atrophy of the fibres, leaving the cells almost unchanged.[1] The changes in the skin are very marked.

[1] I have examined Dr. Hadden's specimens, and adopt the first six lines of his report, but hesitate to endorse the ninth and tenth. The blood-vessels appear

All the hairs seen in the sections are broken off short, none reaching to the surface. The fibrous layer of the hair sac is much thickened by a nucleated fibrillated tissue; the inner and outer root sheaths are obscured by a small round-celled growth, so that no normal structure can be seen. The coiled tubes which compose the sweat glands are filled with closely-packed small round cells, which become deeply stained by colouring matters; there is no lumen, and the polyhedral cells which normally line the interior are quite absent; the sudoriferous ducts near the sebaceous follicles are also blocked with similar cells; the adventitia of the small arteries seems unusually thickened. In one portion of the skin the fibrous bundles of the corium and superficial part of the subcutaneous tissue are separated one from another, but this appearance is probably artificial, for in most specimens no such condition is observable. The elastic fibres exhibit no change."

The brain and spinal cord were firm and apparently quite healthy. Apart from the morbid changes above detailed two main facts were obvious. Firstly, *the quantity of blood was small;* although the heart was contracted and empty, and one lung was degenerated and much less vascular than the normal organ, there was no noticeable fulness either of the superficial veins during life or of the great internal veins after death. Secondly, *all the tissues were abnormally firm and tough:* there was a general increase of connective tissue throughout the body. This was well illustrated in the muscles. For the purpose of the chemical examination of the tissues, the results of which are given below, I procured a new "Nye's mincing machine." It minced ordinary flesh readily and perfectly, but on trying to pass the rectus abdominis muscle of the patient through it, the knives became

to be wider and more numerous than usual. It would be interesting, of course, to find such widespread implication of the sympathetic in these cases, but I think that the symptoms in the case under consideration are sufficiently accounted for by the involvement obvious to the naked eye, of the *thoracic ganglia.*

entangled in tough strings of fibrous tissue and the instrument was so much a failure that I had to resort to the old plan of "the chopper and block."

Chemical Examination of the Tissues.—My object was simply to determine the amount of mucin. The process which I adopted was as follows:—One part of the tissue (15 grammes=238 grains) was pulped or minced and digested for a week with frequent agitation in seven parts (107·9 cubic centimètres = 1666 grain measures) of fresh lime-water at 60° Fahr., and then filtered. The residue was then macerated in a fresh portion of lime water for from four to eight hours at a temperature gradually rising from 60° to 110° Fahr. At the end of this operation the softer tissues were completely disintegrated. The solutions were then filtered, and the mucin both of the first and second filtrate precipitated by acetic acid, collected upon a filter (associated with a second of equal weight made from the same sheet of paper), washed with water acidulated with acetic acid, and estimated in a dry crisp state. In the second maceration it is obvious that if chondrin were contained in the tissue, the amount would be included in the figures representing the amounts of mucin. But it may, I think, be assumed to be absent from all the tissues examined except the lungs. In the estimation, however, given below no artificial heat was employed, the second maceration (with heat) giving no appreciable precipitate with acetic acid.

The following is the result:

Percentage of Mucin in the following Tissues of Harriet B—.

Skin	0·525
Sheath of rectus	1·239
Subcutaneous fat of abdomen	0·176
Muscle	None
Lung[1]	1·600
Kidney[1]	0·804
Spleen	None

[1] I regret that I failed to note the parts of the organs from which the

I am not aware that the proportions of mucin and the other constituents of healthy tissues at various ages have been ascertained, and until this has been done, the value of the foregoing data is of course unknown. As a help to myself and future inquirers, I have determined this question to some extent in respect of a woman, Eliza B—, æt. 24, who died under my care in St. Thomas's Hospital. She was the subject of mitral disease. There was slight œdema of the eyes, and a little fluid in the serous cavities.

Percentage of Mucin, Albumin, and Gelatin in the following Tissues of Eliza B—, æt. 24.

	Mucin.	Albumin.	Gelatin.
Skin	0·17	0·68	19·50
Sheath of rectus abdominis muscle[1]	0·28	3·63	21·79
Subcutaneous fat	0·01	0·65	1·72
Muscle (rectus abdominis)	0·73	14·65	2·16
Lung (thin anterior border)	0·31	6·62	5·64
Kidney (cortex and medulla equally)	1·09	3·82	3·47
Spleen	None	Abundance	Abundance

The tissues, drained of blood and finely minced or pulped, were digested in seven parts of lime-water, and subsequently in a fresh portion at a temperature ranging from 110° to 160° Fahr.; the skin and tendon requiring the higher temperature in order to effect a complete solution. Indeed, all the tissues may be at once exposed to the higher temperature, when the process may be speedily effected. I used cold lime-water at first, thinking that heat might cause some decomposition of the mucin. A carefully performed experiment on bronchial mucus proved to me that mucin in lime-water undergoes no diminution when exposed for many hours to a temperature over 160° Fahr.

The process adopted was as follows:—Solution of the tissue having been effected, the filtrate was supersaturated

portions analysed were taken; the significance of this (see p. 199) occurred to me subsequently.

[1] The large quantity of albumin was no doubt derived from adherent muscular fibre.

with acetic acid, precipitated mucin was collected upon a filter (placed by the side of another which served as a counterpoise, being of equal weight and equally saturated with the solution, and washed and dried together), washed, and dried. The filtrate was next treated with solution of potassium ferrocyanide so long as any precipitate formed; the albumin was collected, washed with water acidulated with acetic acid, dried, and weighed. The filtrate was lastly precipitated by freshly prepared solution of tannic acid, and the gelatine collected, washed, and dried.

In ascertaining the amount of mucin it is necessary to state the part from which the specimen was taken; for example, the cortical part of the kidney will yield less mucin than the medullary portion, and the lining membrane of the pelvis more than the medullary portion. Again, with regard to the lung, it will be obvious that the thin edge of the lung will yield less mucin than the central parts, because a portion from the latter contains larger and more numerous bronchia than the former. The quantity of albumin, too, will vary with the amount of blood retained in the tissue.

The following observation shows this:

James P—, æt. 37, died under my colleague, Dr. Stone, of enteric fever and pulmonary congestion.

Percentage of Mucin, Albumin, and Gelatin.

	Mucin.	Albumin.	Gelatin.
Kidney cortex	0·064	4·34	4·34
„ medulla	0·64	4·30	6·19
Lung, diaphragmatic edge .	0·42	0·43	8·42
„ root	3·43[1]	1·95	11·89

Taking the two analyses together, it appears that, of those examined, the organs which yield the largest amount of mucin are the lungs and the kidneys. This was of course to be expected since the mucous membrane freely extends into both of them.

[1] This large figure represents the combined amount of mucin and chondrin, by far the greater proportion being chondrin.

Further observations will determine whether or not the quantity of mucin in the tissues of the myxœdemic patient is in excess. Compared with the analysis in the other case, the total amount is nearly double, and so far, Dr. Ord's idea of a "myxœdema" is borne out. But it appears to me that the question of an increase of mucin sinks into insignificance in face of the unmistakably great increase of the connective or fibrous tissue, and to which the increase of mucin, if this be hereafter demonstrated, may be regarded as secondary.

The morbid condition in the myxœdemic case was associated with a general increase of the fibrous tissue at the expense of the parenchyma, and hence the integumental thickening and puffiness, and the increased hardness and toughness of the tissues. Such a case as that I have described might be appropriately defined as one of "*general fibrous invasion*," producing a *chronic, cold debility*.

In this case, one lung was degenerate and useless, and as a consequence, the vital functions were proportionately reduced; the temperature was low and the urea reduced to half the normal amount. As a secondary effect, the parenchyma, adapting itself to the wants of the system, had decreased, and its place was supplied by connective tissue, which in process of time had become dense and inactive.

It remains to be considered how far the nervous system is involved in the general fibrous degeneration. In the case under consideration the cerebro-spinal system was evidently very slightly affected; the mechanism of thought, speech, and motion were more or less impeded, and there was a slowness of each proportionate to the general debility; the intellect, however, remained unclouded, and there was an absence of paralytic symptoms. But the sympathetic system is in many of these cases more deeply involved. Since these cases have come under my notice I have always referred them to degeneration of the sympathetic centres. A case of so-called "simple

atrophic sclerema," but really one of fibrous degeneration of the lungs and thoracic sympathetic, published by me in vol. lx of the 'Transactions' of the Society, is conclusive on this point; and the present case is as strong a corroboration as can well be offered. The myxœdemic and scleremic conditions in these patients were merely the consequence of severe internal inflammation experienced years before and affecting, *inter alia*, the pleuræ and peritoneum and the sympathetic ganglia adjacent to these membranes. It is easy to trace the effect of this, viz. a loss of tone in the blood-vessels of the connected viscera and a corresponding diminution of functional activity. The blood-vessels are the first organs to be affected by fibrous degeneration; the implication of the rest follows as a matter of course.

In the two cases to which I have just referred, fibrous degeneration of the lung was a notable factor in the disease, but it is of course conceivable that myxœdema (general fibrous invasion) or scleroderma and its allies may have their origin in inflammatory or other changes exclusively confined to the sympathetic ganglia.

If this view of the pathology of the disease be correct, myxœdema cannot be regarded as a specific disease, but merely as a variety of what I have termed "a chronic, cold debility" dependent on depression of the vital functions and frequently associated with fibroid degeneration of the lung, a condition usually, if not always, traceable to some severe antecedent illness attended by internal inflammation.

I am able to present to the notice of the Society to-night a patient of the male sex, who may be regarded as a typical example of myxœdema, and whose history and condition are strongly corroborative of the views here advocated. The following is a brief outline of the case:

George K—, æt. 52, a seaman, who has followed his profession until a few years ago. He is still a well-developed man, 5 feet 10½ inches high, weighing 14 stone, and well covered with fat; circumference of chest 37½

inches, of thighs 23¾, of calves 17¾. The ankles and insteps are very œdematous, and there is pitting over the tibiæ as high as the knee, and also of the sides of the calves on making hard and prolonged pressure. For the last month the face, which before was puffy, has been distinctly œdematous around the eyes, and the integument over the upper lids hangs down as semi-transparent sacs. The lips are hard and swollen, so as to impede labiation, the voice is gruff and monotonous, and the speech slow and hesitating. The cheeks are rosy, from chronic injection of the small vessels. The thyroid gland is evidently absorbed. The skin is cold and dry, and the extremities, especially the arms and hands, are quite rough with epidermal scales ; the hands and fingers are thick and clumsy and the nails incurved, those of the forefingers completely covering the end of the pulp ; the hair is coarse ; the urine is normal in quantity, always free from albumin, sp. gr. 1013—1020, and acid.

He has been in the hospital under my care for the last six months, and his condition has remained unchanged, except that during the last month there has been a slight increase of œdema.

He complains of weakness and giddiness, weakness of memory, dimness of vision, and dyspnœa on the slightest exertion ; his gait is slow and heavy. The pulse is 70, but very small and weak ; the impulse of the heart is absent and the sounds scarcely audible, but there is absence of valvular disease ; the expansion of the chest is very imperfect, there is a little dryish crepitation at the bases of the lungs ; over the right upper lobe and the left upper lobe in front the expiration is audible and prolonged. The right chest is dull below the nipple line from front to back, the dulness being most marked at the side where it extends an inch above the nipple line ; in every part of this lung the breath sounds are feeble, and there is marked increase of bronchophony and vocal vibration ; there is neither cough nor expectoration, nor any history of previous bronchitis. His appetite is very moderate, and the

digestion is weak; he is frequently troubled with nausea and heartburn, and has occasional attacks of vomiting, a condition very like that which was so prominent in the case of scleroderma above referred to (see p. 201). The average temperature for August and September (forty-one observations) was 97·4°.

He was a remarkably strong man until 1854, when he had measles and smallpox. The latter illness occurred on board ship in the English Channel; he had no medical attention and was ill three months. Since this time he has not been strong, and subsequently he had an attack of dysentery lasting six months. Five years ago he had erysipelas of the head. He has always been subject to rheumatism of a subacute form, aching of the legs and arms. Two of his brothers have died of chronic heart and lung disease, a third of chronic lung disease, and a sister of "fits."

The patient has gradually and very slowly lapsed into his present state. He is not confined to bed, and can still walk a distance of a mile, but breathlessness is easily provoked by very moderate exertion of any kind.

During the last few weeks this patient has experienced an increase of the œdema of the legs, and the swelling of the lids almost occludes the eyeballs. He has lately suffered an attack of conjunctivitis and slight iritis of both eyes. It was doubtless of rheumatic origin. The œdema of the legs is now very great. This patient I have quite recently discovered was under Dr. Stephen Mackenzie's care in the London Hospital, and he has given an account of him in the last volume of the 'Clinical Society's Transactions' (vol. xvi, p. 260).

I have thought it would be premature to examine the few cases of myxœdema that have been published in reference to the views set forth in this paper. What appears to be needed at the present time is a full and complete history of the cases as they present themselves to us, and thus we shall acquire the facts necessary for generalisation.

One question in the pathology of myxœdema I have left

unconsidered. It is the relation of the thyroid gland to the disease.[1] I have noted the atrophy of the gland in chronic lung disease, especially fibroid degeneration, and I believe that a depression of the respiratory function will be found to be the usual associate of atrophy of the thyroid; the activity of the gland being associated with increased blood-supply as in the plethora which sometimes follows the natural cessation of the catamenia; while its atrophy may be expected when, by degeneration of one half of the respiratory surface, the blood is proportionately impoverished.

[1] See Dr. Stephen Mackenzie's paper, "On the Weight of the Thyroid Body," at the end of the volume.

A CASE

OF

SIMPLE ATROPHIC SCLEREMA,

ASSOCIATED WITH

DISORDERS OF THE CIRCULATORY AND ALIMENTARY FUNCTIONS.

BY

JOHN HARLEY, M.D. Lond.,
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Read January 23rd, 1877.

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SENIOR ASSISTANT PHYSICIAN TO, AND LECTURER ON GENERAL ANATOMY AND PHYSIOLOGY AT, ST. THOMAS'S HOSPITAL.

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The following history will form a fitting supplement to the preceding paper by Mr. Gaskoin, as, while the case presents many points of agreement, the apparent differences are probably only those which may be expected to result from a difference in the exciting cause, and to the circumstance that in Mr. Gaskoin's case the morbid action has hitherto chiefly affected the peripheral parts, while in my own case the central organs have been from the first more deeply implicated.[1]

William W—, æt. 45, a stonemason, came to me in March, 1872, complaining that he was no longer able to work from inablity to close the hands upon his tools.

He stated that the disease began with "a little cold and

[1] I am indebted to Mr. Gaskoin for opportunities of studying his most interesting and instructive case.

indigestion," in the preceding September, when he was taken with a sensation of "great weight" in the epigastrium after food. It was accompanied by "terrible retching," but nothing was ejected except a little watery fluid. Under medical treatment the symptoms subsided, and then the hands gradually assumed their present condition.

He has remained constantly under my care up to the present time, so that my observation of his condition has extended uninterruptedly over a period of more than five years.

Speaking generally, the hands have undergone no change, but his health has declined, and changes associated with those affecting the hands have been gradually developed during this period.

The patient, now in his fiftieth year, is of moderate build. He is fair and has blue eyes, scanty reddish whiskers, a bushy head of hair just turning grey, and a thin, delicate, and only slightly pubescent skin; the lobes of the ears are prolonged and adnate.

Although he has latterly become somewhat anæmic, he still retains traces of a naturally ruddy complexion, due to the permanent injection of fine networks of minute cutaneous vessels.

He is the father of five healthy children, aged twenty-three, twenty, seventeen, thirteen, and nine, respectively; he has lived a careful, temperate, and industrious life, and has suffered but one illness, a severe attack of well-ascertained typhus, ten years before the present condition came on. He was able to resume work about thirteen weeks after he succumbed to this fever. His recovery was complete and was retarded by weakness only.

From the age of twenty-five to thirty-seven, he was occasionally troubled with small sluggish boils appearing about the back of the neck, and the white scars of two or three of these boils are still present below the nape.

His normal weight is about eleven stone, with very slight variation. He considers himself to have possessed average muscular strength, but from boyhood he has had

a tendency to faintness with outbursts of perspiration when in a close atmosphere. He has also been liable to flushings, and has always perspired freely, and on the least over-exertion, profusely. He has smoked since the age of twenty, his usual daily allowance of tobacco being from a quarter to half an ounce. He never experienced uncomfortable effects from its use, and he still smokes about half of the above-mentioned quantity.

His remote ancestors were mostly long-lived; his father and mother died early, but all their children are alive and moderately strong.

The father died after eight months' illness, at the age of thirty-eight, and when William W— was fourteen years of age, "of enlargement of the heart followed by dropsy." His son does not know whether it was of rheumatic origin or not. The mother experienced an attack of bilious and nervous fever (probably enteric) shortly after her marriage, and was ever afterwards a delicate woman.

She married a second time, and the issue of this marriage, a son, is alive and well. She eventually died of "consumption" at the age of fifty-one.

To return to William W—. When he first came to me, and for a year or more afterwards, he presented nothing unusual in appearance, nor, perhaps, would a casual observer have noticed anything amiss with his hands. There was no enlargement or œdema of any part of them, but on near inspection, the fingers from the first joints to the tips were seen to be sometimes rosy, but more commonly dusky, and on some days livid; and on taking either hand into your own it felt from the wrist downwards as cold as that of a corpse. The fingers were rounded, smooth, and hard, like tendon; no pitting could be produced by pressure, and it was impossible to pinch up the least fold of skin, the mobility of which was reduced one half, and it appeared to be tightly drawn over a hard substratum, so that the hands were constantly kept open, and it was impossible to close them completely.

After prolonged efforts he could, indeed, bring the finger-

nails of the left hand in contact with the palm, an inch and a quarter below the upper border of the hand (the anterior fold of the wrist), but he could not bring any nail of the right hand in contact with the palm, and after the strongest effort the finger-ends impended at the distance of an inch over the upper limits of the palm.

This induration of the areolar tissue was marked around the wrists, and gradually ceased about four inches above the joints.

The wrists were kept straight, and were still capable of limited movement; coercive attempts to flex or extend the hands caused pain, and the slighter disturbances incurred by their necessary use produced an intermittent aching, which was much complained of. The rotatory movements of the forearms were reduced to one half, *i.e.* the plane of the palm in passing from extreme supination to extreme pronation, described a quadrant only.

A fine creaking or grating is often felt immediately under the skin, by a finger placed on the back of the wrist when it is in motion.

The hands perspired freely, and the fingers were usually damp—some days even wet—as well as cold.

The actual temperature of the fingers was usually from 3° to 5° only above that of the external air; and from 30° to 40° below that of the axilla. After sitting in a warm room before the fire, and when warm in bed, the temperature of the fingers has become nearly 10° higher than that of the external air.

These facts, and the comparative temperatures of various parts of the body, are given in the accompanying table.

Temperature (Fahr.) of the fingers and hands, as compared with that of the apartment and other parts of the body.

	Air.	Fingers	Palm.	Axilla.	Mouth.	Toes.	Sole.	Ankle	Remarks; condition of fingers.
1872, Sept. 18	60°	60°	65°	98°	...	81°	82°	83°	
Oct. 2	60	65	66	97·5	98				
10	60	65	70	98	...	65	75	80	
16	59	60	63	93	...	...	...	...	Very dusky.
23	58	63	63	97·2					
30	57·2	63·5	65	...	99				
Nov. 13	52	55·5	59·25	...	100	...	...	...	Very livid.
1873, April 30	54	60·7							
1874, Sept. 22	67	66							
Oct. 6	61	64	...	...	90				
1876, Aug. 15	61·5	70·5[1]	...	...	99				

The sense of touch was very slightly, if at all, diminished; and the tips of the index fingers, which certainly had their full share of the disease, maintained their natural superiority. Thus, the limit of confusion for the whole hand occurred when the points of the compass were less than two lines apart; whereas the tips of the index finger discriminated two points when they were separated by an interval of only a line and a half. The nails were perhaps a little more incurved at the edges than usual, but their nutrition and growth were normal.

Such, I repeat, was the state of the hands nearly five years ago, and as there were no other indications of disease at this time, I was greatly puzzled as to the nature of the local disorder. I was inclined to attribute it to disease of the arteries of the hands, leading to dry gangrene, and thought of the stories of ergotised grain. But the patient had always resided in London, and the radial arteries, in common with those of the rest of the body, were soft and full. Subsequently, I was satisfied that the impediment to the circulation was due to the induration of the integument, which necessarily interfered with the movements of the arteries. From the further course of the disease it

[1] After sitting two hours before a fire.

may be assumed that the adventitia of the arteries, at least, was involved in the sclerema, thus preventing the expansion of the vessels.

Up to the present time the hands have remained unchanged, excepting that a hard, linear scar has formed obliquely across the palm, firmly binding the skin to the subjacent fascia, and that gangrene has actually declared itself, although in the very slightest degree. A year ago the first indication of this change showed itself as a minute, depressed brown scale on the extreme tip of the right middle finger, attended by sharp throbbing and shooting pain in the part. A speck-like cicatricial shrivelling now marks the seat of this change. Three months later on, the tip on the right index finger was similarly affected, and healing was attended by the discharge of a little thin pus. In November last this action was renewed at the tip of the same finger, and was accompained by a moderate degree of inflammation, resulting in the separation of the cuticle of the forepart of the finger. A little discharge still continues; the forepart of the nail is separated, and the finger tip is slightly truncated.

The face was observed to be gradually losing expression, the mobility of the skin, especially over the malar bones and forehead and of the scalp, decreased, and the subcutaneous tissue grew firmer. Simultaneously the affection spread over the neck and upper part of the chest. The subcutaneous tissue of the abdomen is unaffected, but the aponeurosis of the external oblique muscle at least is implicated, for the moderately protuberant walls of the abdomen are hard and unyielding, and this condition is a source of discomfort to the patient. The fibrous tissue around the knees appears to be similarly affected. The other parts of the body, even the back immediately below the vertebra prominens, are at present free from the disease.

The expression is that of melancholy impassiveness; the mouth is always closed, and the lips somewhat compressed. A permanent hard ridge is seen across the forehead. It is produced by pressure of the hat.

The pleasant emotions may still evoke a ghastly smile, but the opposite passions have no longer power to contract the brow.

The characteristic features are, however, best displayed on the neck. When the head is thrown back, complete extension is prevented by the superficial fascia in front of the neck, which forms a thin, hard, resisting plane beneath the skin, gathered from the sternum and clavicles upwards into slight vertical ridges, feeling like knotted cords. Here the skin is free, but lower down, as far as the second costal cartilage, it is drawn very tightly over the subjacent parts, and in passing from the root of the neck, over the sternal ends of the clavicles and the manubrium, it attains its maximum degree of immobility, and is not only highly polished but partially eburnated in appearance. The surface is still further diversified by pink spots or little patches of minute straggling vessels, rendered conspicuous by the poverty of the skin in which they lie. The sides and back of the neck are brawny. On a cursory examination it appears seamed or furrowed, coarsely about the nape and just above the clavicles, and finely below the ears. The skin, however, is perfectly smooth, and the alteration is due to a partial disappearance of blood-vessels from the naturally rosy surface, which is now broken up, in the regions above stated, into red and white areolæ, varying in size from half a line to three lines in width, and arranged alternately with considerable regularity. The pink areolæ exhibit to the naked eye ramifications of minute blood-vessels, such as are seen in this and other parts of the surface in persons freely exposed to the weather. The extremities of these vessels terminate abruptly in the margins of the colourless areolæ. These latter are of ivory-like whiteness and opacity; here and there a minute blood-vessel from a contiguous vascular areola may be seen streaking it with pink, but usually the colourless areolæ are absolutely bloodless. These characters are clearly and conspicuously displayed under a low magnifying glass.

Towards the shoulders and back the red and white

mottling gradually disappears, the white areolæ becoming larger, more diffused, and, losing their ivory-like appearance, gradually assume that of the healthy skin; correspondingly the pink areolæ becomes smaller and less vascular, until they are reduced to mere points, and ultimately disappear; and thus the morbid and natural tissues are imperceptibly blended.

The skin of the affected parts retains, as far as I can determine the fact, the normal amount of sensibility. A distance of five lines between the points of the compasses is the limit of confusion for the whole of the side of the neck, but when the points are placed on the *areolæ atrophicæ*, at the root of the neck, they are rarely discriminated as two when fully an inch apart.

The skin generally has a slightly freckled and somewhat dirty appearance, particularly about the sides of the chest, due to a little increase of pigment. The adipose tissue has entirely disappeared from the integument of the upper extremities, the neck, chest, and back, the muscles of the arms are much wasted, and the borders of the scapular muscles are apparent under the thin skin. The lower part of the body and the lower limbs are in fair condition, and if the muscles of expression, the platysma myoides, the lumbricales doubtless, and perhaps the external oblique of the abdomen, be excepted, the muscular system must be regarded as free from disease. The wasting of the muscles of the upper extremities is clearly due to inaction.

Thus much respecting the local disease. I pass now to the general condition of the patient. He is weak and anæmic, and the neck and shoulders stoop. The curvature of the neck is mainly, if not altogether, caused by the contraction of the superficial fascia in front of it producing a forward inclination of the head.

But the most serious troubles are those which arise from associated disturbance of the circulatory and digestive organs.

During the first two years of the disease the pulse was

normal, tranquil, regular, of good volume, and moderate force, and ranging between 70 and 80. Shortly afterwards it began to intermit once or twice in the minute. This defect increased rather rapidly, and attained its maximum during the fourth year, when the heart's action exhibited remarkable variations, which have continued ever since. Sometimes the pulse is only 40 to 42, the beats regular and equal; but on listening over the heart 80 to 84 regular, but unequal ventricular contractions, are clearly audible, a feeble one regularly alternating with the stronger, which alone are appreciable at the wrist. But the most remarkable feature is that occasionally the feebler beats are altogether eliminated, the ventricular contractions being reduced to the same number (40 to 42) as the radial pulsations, the action meanwhile being quite equal and regular.

This regular intermission of the pulse and reduction of the cardiac contractions gives place either to the normal state—a regular pulse of 72 to 80, synchronous with the ventricular contractions—or to the usual form of irregular action in which the cardiac contractions being of unequal force the radial pulsations have a corresponding character with frequent intermissions. This latter is the common state of the pulse at the present time.

Associated with the gastric symptoms, which I will now describe, the patient has severe attacks of cardiac pain, with breathlessness, palpitation, and faintness. In the patient's own words, "at one time the heart seems as if it would jump out of his chest, and at another that it is not going at all," and he "thinks that he shall die."

The cardiac irregularity above described, has from the first been attended with dyspeptic symptoms, varying in frequency, but often occurring twice or thrice a week.

For the last two and a half years he has almost always complained of a pain, variously described as "heavy, burning, and gnawing," across the sternum on a line with the nipples. But occasionally pain of a more

severe character attacks the cardiac, epigastric, and left hypochondriac regions. It is usually accompanied by flatulency, and ends in severe retching and vomiting of sour or bitter mucous fluid.

Apart from these attacks the patient considers his digestion good. They are not provoked by errors of diet, for his food is of the simplest kind, and his drink only milk and water and weak tea. He has a constant tendency to diarrhœa and the motions are rarely formed.

To sum up. The patient inherits a rather delicate constitution, and this was probably somewhat enfeebled by a severe attack of typhus fifteen years ago. He is now greatly debilitated. A walk of two miles is as much as he can accomplish at best, but oftentimes a much shorter journey proves too much for him; "he feels faint as if he had no breath at all," an inclination to action of the bowels comes on, and a little watery mucus is discharged with slight prolapsus of the bowel.

Frequently after sitting in the cool waiting-hall an hour or two, he presents himself in the prescribing room with beads of sweat on his brow. The pupils are moderately dilated; the frontal vein is large and lax; it lies in a hard deep channel, and becomes full and prominent on the slightest inclination of the head, and a dilating wave of blood is at once thrown back into the vessel by rendering the tissues between the malar bone and root of the nose tense by a slight depression of the cheek, thus plainly indicating the complete absence of tone in the coats of the vein. A narrow line of dusky congestion occupies the margins of the gums; the inner surfaces of the thighs are pervaded by a visible network of fine blood-vessels, and an irregular festoon of similar vessels radiating upwards is seen over the anterior margins of the ribs and epigastrium.

The larger veins everywhere appear healthy. It is necessary to state that the patient is free from both varix and hæmorrhoids.

Apart from his graver troubles, and as a matter of

common complaint, he speaks of "a heavy sensation across the forehead, and a sharp pain across the chest."

The lungs and kidneys are normal, and the urine is poor, the sp. gr. being usually under 1008.

Treatment.—I have used tonics and stimulants, general and local, including ample trials both of digitalis and belladonna without avail. He has taken iodide of potassium at intervals, and has spent some months in the convalescent institutions of Bognor and Walton-on-Thames without advantage. He has lost strength in spite of all that has been done for him, and I cannot but regard the issue as unfavorable.

Pathology.—I have described with some minuteness the condition of the skin of the neck, for here, by the help of a pocket-lens, we may read the morbid anatomy of the disease. We see areas, so regularly disposed as to resemble broken lineæ atrophicæ, from which the blood-vessels have more or less completely disappeared, and the soft, clear, pink skin is converted into a firm, opaque, white, and bloodless structure. While the blood-vessels have collapsed and disappeared the system of lacunæ and canaliculi pervading the healthy connective tissue has shrunk; the adipose tissue for the most part has disappeared, and the soft, moist, and open cushion has collapsed into a hard, close, comparatively dry, and ill-nourished tendinous structure.

I hoped to have secured the attendance here to-night of a spare woman, otherwise healthy, in whom the subcutaneous tissue of the inner surfaces of the fingers and of the palms has become everywhere indurated and compacted with the palmar fascia contracting and fixing the fingers and seaming the narrowed and hardened palms. But such cases are familiar to all of us, and the subject of this paper himself exhibits this condition as it is usually seen, the centre of the right palm being seamed, tucked in, and firmly fixed to the fascia beneath.

The nature of the disease in this patient is illustrated very simply and clearly by these common instances of

partial sclerema of the palm, and the close associations which I here recognise will be a great aid in the proper classification of such examples of sclerema as that under consideration, for it may at once be isolated and distinguished from the greater number of the forty or fifty cases which have been described under the term sclerema and its synonyms. Only three or four of these have furnished opportunities for post-mortem examination.

In Förster's[1] case, which Dr. Fagge regards as an example of Addison's keloid, the corium and connective tissue were confused, forming a homogeneous white tissue, from which the fat had vanished, and the sclerosed connective tissue was firmly bound to the muscles, fasciæ, and tendons, and the author regards the change as due to "a chronic process of proliferation in the connective tissue of the corium, and particularly of the subcutaneous tissue, unattended by fever or local inflammatory symptoms."[1] It is implied that there was an increase of connective tissue in this case. Kohler,[1] Auspitz,[1] Arning,[2] and Day,[2] expressly state that such was the case in their patients, and they especially mention an increase in the elastic element.

I cannot introduce a comparison with Rasmussen's[3] case, for it appears from the progress of the disease, as well as from its anatomical characters (free cell infiltration of the connective tissue), to have been a case of cancerous induration of the skin.

The question of hypertrophy of the skin and subcutaneous tissue, when these have coalesced, excluding due consideration of the adipose element, is one that must be answered very cautiously in any case, for it is certain that before we can know that any absolute increase has taken place we must previously know the

[1] Referred to in Day's paper, 'American Journal of Med. Sciences,' 1870, vol. lix, p. 357.

[2] For references, see Classification, p. 149–150.

[3] 'Scleroderma, and its relation to Elephantiasis.' Translation by Dr. W. Moore, Edinburgh, 1867.

thickness and consistency of the pre-existing adipose layer. Of the "proliferation of the connective tissue," so freely spoken of by Förster, neither he nor any other observer gives us any proof. Kaposi, indeed, found in one of the cases under his observation a "stasis of lymph-cells in the perivascular spaces," and he assumes that "this stasis and stagnation of lymph in the interstices of the tissues occurs in the production of scleroderma, the connective tissue being formed in excess out of the accumulated superfluity of nutritive material."[1]

That the integument may be thickened and hardened by lymph stasis is obvious enough, but that growth of the connective tissue takes place as a consequence is a pure assumption. Nor, indeed, can Kaposi's case be regarded as typical, for the patient had lupus erythematosus, œdema of the legs, repeated attacks of "urticaria" in the affected parts, recurring rheumatic pains, and thickening and hardening of the bones of the legs—symptoms which are commonly associated with a specific irritation of the lymphatics.

Watching, as I have done, the gradual development of the disease in my patient, I can affirm that there has been no "proliferation of connective tissue" in his case. At no time has there been the slightest enlargement of the affected skin; on the contrary, the parts affected, —excepting perhaps the fingers, which have continued throughout in a chronic state of venous congestion from mechanical impediment to the return of blood,—have shrunken.

The atrophy is, of course, due in part to the more or less complete absorption of fat, but an examination of the skin in front of the neck of this patient, in which the disease is still progressing, will, I think, be sufficient evidence of that for which I contending, namely, that the disease in this particular case is due not to an increase of the subcutaneous connective tissue, but to its atrophy *ab initio*.

[1] Hebra, 'On Diseases of the Skin,' Syd. Soc., vol. iii, p. 123.

But what, we may ask, is the cause of this atrophy of the nutrient canals? of this conversion of skin into tendon? "Doubtless, some affection of the vaso-motor nerves" is the reasonable answer.

That the sympathetic nervous system is generally involved in this case, appears to me certain. The fnnctional derangements of the heart, stomach, and intestines, the lax condition of the coats of the blood-vessels, the easy provocation of sweat, and progressive inanition, are to me marks of a grave depression of the sympathetic—of a slowly advancing paralysis of this system of nerves, of which the subcutaneous atrophy is but the superficial indication.

The case narrated is remarkable for the slow progress of the sclerema, and for its unmistakable association from the first with derangement of the central organs. In the cases recorded, disorder of the stomach or heart, or of both, is mentioned in only four or five.

In Rilliet's[1] case, the disease was ushered in by a sudden and violent pain in the epigastrium, accompanied by very intense palpitation, but these symptoms, as well, indeed, as the sclerema, may properly be referred to inflammatory irritation of the serous surfaces (in which I include the areolæ of the connective tissue), for at the end of a week or ten days, when the induration was subsiding, slight ascitis, and effusion into the right pleura and pericardium were noticed.

In Barton's[2] case the sclerema was preceded by dyspeptic symptoms, failure of appetite, and sickness after meals, with occasional vomiting.

But the cases which in several particulars most closely resemble that under present consideration, are those related by Dr. Arnold of Baltimore,[3] and Dr. Day of New York.[4] In both of these, derangement of the digestive and circu-

[1] 'Med.-Chir. Rev.,' 1848, p. 79.

[2] 'Dublin Quart. Journ. Med. Sci.,' Aug., 1869.

[3] 'American Journ. Med. Science,' July, 1869, vol. lviii, p. 89.

[4] Ib., April, 1870, vol. lix, p. 350.

lating organs, were prominent symptoms. The troubles in the latter case were proved, however, both by the post-mortem examination, and by the physical signs during the progress of the disease (pain and fine crepitant râles in the upper part of the lung, and thence to the præcordia, &c.), to be due to chronic pleuritis, pericarditis, and peritonitis.

In the case before us, the disease has entered its sixth year, but there are no positive indications of organic disease in any of the viscera; the chest movements are free, the percussion note is good, and the breath-sounds for one in his debilitated condition, may be considered normal. Expiration is, indeed, slightly audible in all parts of the lungs, and the gentle vesicular murmur of health is somewhat encroached upon by a proportionate increase in the bronchial sounds—changes which, in an ordinary case, one should unhesitatingly refer to diminished elasticity of the lung, but which in this may be regarded as an indication of fibrous degeneration of the lung tissue.

At present the heart cannot be charged with organic disease, and the gastric symptoms are referable rather to defective or vitiated secretions than to peristaltic action hindered by adhesions.

Dr. Arnold's is really the only case which resembles that under consideration, for the two agree both in the duration of the disease and the attendant troubles of the alimentary canal. That these were merely functional in Dr. Arnold's case, appears from his statement, that "the cardiac and thoracic functions were normal, but the pulse was weak and slow."

So far then this case is almost unique, and as the disease is still in its mid-career, further opportunities will be afforded of watching its progress, and of testing the accuracy of the conclusion which I have drawn, respecting its nature and associations.

The slow progress of the disease suggests one other consideration. In most, if not all, of the recorded cases, the peripheral disease—the scleroderma—has been the prominent affection, and few fatal issues are recorded; in

the case under present consideration, the sclerema has become quite secondary to the grave disturbances of the circulatory and nutritive functions. How far the central disturbances interfere with the peripheral affection, or whether they do so at all, is a question worthy of consideration. I find it noted in Dr. Day's case, that an attack of vomiting and purging, lasting some days, was followed by "a great amelioration in the condition of the skin, which lost much of its bronze colour, became softer and more supple, and in parts could be moved over the subjacent tissues."[1] If we may recognise cause and effect here, then we have an explanation why the sclerema in my patient has during these five years made so slow a progress, for vomiting and occasional diarrhœa have never been absent from the first, and during the last three years they have been frequent and severe.

In conclusion, I venture to make a few remarks on the classification of the variety of disorders of the skin and subcutaneous tissue, which have been or may appropriately be included under the term sclerema and its synonyms.

Dr. Hilton Fagge[2] has done good service by bringing together "Keloid, Scleriasis, Morphœa, and some allied affections," and pointing out the relations between them; but the case which I have narrated to the Society, and that very interesting one recently brought under its notice by Mr. Gaskoin, throws additional light on the subject, and call for some further generalizations.

The terms *sclerema* and *scleriasis* are well suited for embracing these affections; *scleroderma* as a generic term is insufficient, since it implies an affection of the skin alone, whereas the morbid process in every case, involves the subcutaneous connective tissue, and in most, if not all, has its origin in this structure, the derm being usually involved in the later stages of the disease only.

Dr. Kaposi[3] defines sclerema (scleroderma) as "diffuse

[1] Loc. cit.; see also the Appendix to this communication, p. 151.

[2] 'Guy's Hospital Reports,' 3rd ser., vol. xiii, p. 255.

[3] Hebra, 'On Diseases of the Skin,' New Syd. Soc., vol. iii.

hypertrophy of the connective tissue," and of course places it in a class quite distinct from "xeroderma[1] or parchment skin," since he defines this as "diffused idiopathic *atrophy* of the skin." He says, "the course and development of sclerema and xeroderma, seem to distinguish them in a marked degree from one another. In the former, the disease commences as a board-like infiltration of the subcutaneous connective tissue, the corium being involved later and in certain parts only, the epidermis not at all, or only in the later periods of the disease. In xeroderma, the shrinking, the atrophy, appear to begin in the papillary layer and the epidermis, and from thence only to spread to the corium. This is evidenced by wrinkling of the epidermis, disturbance of the pigment, and the quantity of small superficial teleangeiectases." (p. 256).

He disregards the fact that atrophy of the papillary layer is attended by a proportionate loss of sensation. Thus, in the first case, a girl of eighteen, the xeroderma had existed "from early childhood," but "the sensibility of the skin was not diminished." In the other cases, the disease had existed in one, a girl of ten years, "from earliest childhood," and in the two others, "from the age of twelve months." The tactile condition of the skin is mentioned in the first case only, and it is obvious that if the papillary layer of the derm had been the seat of diffuse atrophy for a period of ten years only, the sensibility of the skin would not have remained intact as it is stated to have been. Hence it may be concluded that the special seat of the disease in so-called xeroderma is not the papillary layer. Then as to the condition of the epidermis, "disturbance of the pigment," "checkered pigmentation," certainly does not exist less frequently in sclerema than it does in so-called xeroderma. In Mr. Gaskoin's case, where xeroderma (ξηρὸς, parched) and sclerema are most

[1] Those authors to whom these high-sounding but trivial words are apparently of so much importance, should be careful to give them their proper meaning. "Xeroderma" no more denotes "parchment" skin than does the term "cutis anserina" or "pachyderma."

completely associated, there is not only confusion, but frequent interchange of all their supposed destinctive characters. As to wrinkling and shrivelling of the epidermis, this is merely the effect of the atrophy of the subjacent corium, and may be taken generally as a mark of the age of the disease. In only one or two of the recorded cases of sclerema had the disease existed so long as five years, and in none of Kaposi's cases of xeroderma had it existed for less than this term, and he had no opportunity of seeing either of them, until the disease had attained this and a greater age; he has, therefore, no ground for assuming that the morbid changes commenced in the papillary layer. Indeed, if supposition is to take the place of fact, it were more reasonable to assume that these cases of xeroderma originated in "Sclerema neonatorum," a condition indistinguishable from the "Sclerema (Scleroderma) adultorum."[1]

There is only one more of Dr. Kaposi's distinctions that requires notice. It is the presence of small superficial teleangeiectases. These are not infrequent in sclerema; they are characteristic of one form at least of keloid, and they form a very prominent feature in the case which I described.

If the preceding considerations have the force I consider them to possess, it follows that the lines which have been set to differentiate sclerema from xeroderma, and Scleroderma adultorum from S. neonatorum, can no longer be maintained, even as an aid to classification. The only question that remains is, the relationship that elephantiasis, leprosy, and tubercular diseases of the skin generally, bears to some cases of sclerema—such as that of Mr. Gaskoin's notably.

Since the essential feature of these affections is hypertrophy and induration of the subcutaneous connective tissue and skin, I think they must be included with sclerema in a general classification. With this view, I would define

[1] A comparison of the records of the cases included in the œdematous variety of sclerema (see p. 149 of this paper) with "Sclerema neonatorum" will prove the truth of this statement.

sclerema as an induration of the subcutaneous connective tissue, sooner or later in some degree involving the derm and epiderm, and causing proportionate alteration of structure and disturbance of function. Two or, perhaps, three classes may then be formed :—1. SIMPLE SCLEREMA, or induration without actual hypertrophy of the connective tissue or skin; 2. IDIOPATHIC HYPERTROPHIC SCLEREMA, in which the induration of the connective tissue is accompanied by positive hypertrophy; and 3. SPECIFIC HYPERTROPHIC SCLEREMA, in which may be included the tubercular disease of the skin.

1. SIMPLE SCLEREMA; under this may be grouped the following varieties:

(A) SIMPLE ATROPHIC SCLEREMA, marked by the gradual disappearance of blood-vessels, and shrinking of the connective tissue, so as to attach the corium, more or less completely, to the subjacent fasciæ, muscular aponeuroses, tendons, ligaments, or bones, and unattended by any previous changes in the parts affected.

This may be—(1) *General*, as in the case narrated, and in those given by Bruche,[1] Barton,[2] Day.[3]

(2) *Local*, as in the sclerema of the fingers and palm; in one of Mosler's[4] cases (W. J.); in Case 3, related by Arnold,[5] and further exemplified by Alderson's[6] case; and in those cases of so-called Addison's keloid,[7] which are simply atrophic.

(3) *Scattered*, which will include morphœa, and many cases of partial sclerema.

(B) ŒDEMATOUS SCLEREMA, such as occurs in children (Scleroderma neonatorum), in chlorotic girls, and those

[1] 'Hannov. Ann.,' vii, 5 and 6, 1847.
[2] 'Dub. Quart. Journ. Med. Sci.,' Aug., 1869.
[3] 'American Journ. Med. Sci.,' April, 1870, vol. lix, p. 350.
[4] Virchow's 'Archiv,' B. 23.
[5] 'American Journ. Med. Sci.,' new ser., vol. lviii, p. 89.
[6] 'Medico-Chirurgical Transactions,' vol. xxxvii.
[7] Ibid.

in whom the catamenia are suddenly suppressed (see Thirial's[1] cases, Arnold's case,[2] one of Mosler's[3] cases, two of Rilliet's[4] cases, Fantonetti's[5] case, and Sir W. Gull's two cases quoted by Fagge).[6]

(c) Inflammatory scleremа, including those cases in which the local affection has been preceded by some amount of inflammatory irritation. It may be—(*a*) *Acute,* as in the cases related by Henke,[7] Bouchut,[8] Gillette[9] (which followed the application of a blister), Eckström (which followed an attack of erysipelas),[10] Arning,[11] and by Fuchs.[12]

(*b*) *Chronic,* as in the cases given by Fiedler,[13] Forget,[14] M'Donnell,[15] Nordt,[16] in the very interesting and typical one by Mr. Gaskoin,[17] and those by Sedgwick[18] (partial) Mosler (in one), perhaps that by Grisolle,[19] and that by Förster.[20]

(d) Traumatic, following upon injuries, such as variolous and syphilitic inflammations, burns, the use of the cat, and ulceration.

[1] 'Gaz. Méd. de Paris,' 1845, p. 523.
[2] 'Amer. Journ. Med. Sci.,' new ser., vol. lviii, p. 89.
[3] Virchow's 'Archiv,' B. 23.
[4] 'Traité des Malad. des Enfants,' 1861, vol. ii, p. 107.
[5] 'Annali Universi di Milano,' 1847.
[6] 'Guy's Hosp. Rep.,' 3rd ser., vol. xiii, p. 286.
[7] 'Handb. zur Erkenntniss und Heilung der Kinderkrankheiten,' 1809.
[8] 'Gaz. Méd. de Paris,' 1847, p. 771.
[9] 'Archives Gén. de Méd.,' 1854, tom. ii, p. 657.
[10] 'Hygiea,' Band ii, No. 2.
[11] 'Hygiea,' Band ii, No. 2, and 'Würburger Med. Zeitschrift,' 1861, Bd. ii p. 186.
[12] 'Bericht. über die Med. Klin. zu Gottingen,' 1855, p. 192.
[13] 'Deutsche Klinik.,' 1855, p. 34.
[14] 'Gaz. de Strasbourg,' No. 6, 1847.
[15] 'Dub. Hosp. Gaz.,' 1855, vol. ii, p. 6.
[16] Virch. 'Arch.,' 1861, vol. xxii, p. 198.
[17] Page 113 of this volume.
[18] 'Pathological Trans.,' vol. xii, 1861, p. 234, and vol. xvi, 1865, p. 260.
[19] 'Gaz. des Hôp.,' 1847, p. 209.
[20] 'Würzburg Med. Zeitschrift,' 1861, Band ii, p. 294.

2. IDIOPATHIC HYPERTROPHIC SCLEREMA.—That an increase of the connective tissue and of the skin can occur during the progress of simple atrophy of the integument is obviously impossible. Nor can I consider that actual hypertrophy has been proven in any of the recorded cases, for the reasons stated at pp. 142, 143, but that such a condition may arise in consequence of prolonged subacute inflammatory action so insidious as to exclude it from B and C, Class 1, is possible, and such cases would be properly included in this provisional class.

3. SPECIFIC HYPERTROPHIC SCLEREMA, including the following:

(A) SYPHILITIC HYPERTROPHIES AND CONDYLOMATA.
(B) ELEPHANTIASIS.
(C) LEPRA ARABUM.
(D) MOLLUSCUM.
(E) KELOID (the tubercular as distinguished from the cicatricial form).

Such a classification as the above has the advantage of bringing into a single view a number of morbid conditions more or less closely allied, and each of which will, I believe, throw some light on the etiology and pathology of the others.

All classification is, of course, to some extent artificial; and just as occurs in grouping animals or plants, so here we shall surely meet with cases which will serve as links between the classes above defined.

APPENDIX.—During the present summer (1877) there has been a slight increase of weakness, and the patient has occasionally been obliged to keep his bed two or three days in succession, and the hands have become duskier.

After a sojourn at Walton-on-Thames, the patient presented himself at the hospital on the 3rd of August, when the external shade temperature was about 80° Fahr.

He stated that he was no better, and showed extreme debility. He was perspiring freely; the hands were darker than I had ever seen them, the ends of the fingers being bluish-black and cold. Dry gangrene, indeed, seemed imminent, and the integument over the summit of each metacarpo-phalangeal knuckle of the right hand was occupied by a minute dark adherent scab, like those which formed on the tips of the two fingers, which have undergone slight gangrenous shortening.

The sclerema, however, is less for the first time during the progress of the disease. The integument can now be slightly pinched up over the backs of the proximal phalanges of the right hand, the integument of the neck has lost its brawny consistence, and the skin over the upper part of the chest has resumed its normal appearance and mobility. There is no amelioration of the cardiac and gastric symptoms; the poor patient is a wretched object, the neck being very thin, and the features drawn and expressionless, like those of a mummy.

A SECOND COMMUNICATION

ON

SIMPLE ATROPHIC SCLEREMA.

WITH APPENDIX.

BY

JOHN HARLEY, M.D. Lond.,

SENIOR ASSISTANT PHYSICIAN TO, AND LECTURER ON GENERAL ANATOMY AND PHYSIOLOGY AT, ST. THOMAS'S HOSPITAL.

Read January 22nd, 1878.

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1878.

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(Received December 11th, 1877—Read January 22nd, 1878.)

Louisa M—, a well-developed, unmarried woman twenty years of age, 5 feet 2 inches high, of fair complexion, with blue eyes and yellowish-brown (light auburn) hair.[1] She was formerly stout[2] and of a high colour, now she is thin, semianæmic, and, to a great extent helpless, on account of the condition of her hands. Her family history is moderately good. Both parents are living and in good health, the father forty-seven, the mother forty-three, and both have been free from disease and from tendency to rheumatism or dropsy.

Louisa M— is an only child, and her mother was twenty-five years of age at her birth. Her only paternal uncle died of consumption, "brought on by his own indiscretion." Her paternal grandfather died of "typhoid fever" at the age of

[1] The teeth and hair are strong and healthy, as in the former case.

[2] Her weight at different times is given at p. 106.

forty; her paternal grandmother died of "nervous" debility when over seventy years of age. On her mother's side the grandmother is still living and in good health, and the grandfather died only two years ago. One aunt had rheumatism severely at the age of twelve; she recovered well, but at the age of twenty had a second attack, which completely crippled her, and she was unable to close her hands. She died in her thirtieth year. For five years before her death she was completely blind, and for six months before the final event she was unable to move without assistance. Another aunt, married, but barren, is at the present time attending a hospital for a "tumour of the side." A married cousin (Lydia M—) was bedridden for some years after puberty and could not move without help.[1]

To return to Louisa M—. She had variola badly when only a year old. At the age of two and a half years she had a severe attack of "gastric fever," this was doubtless enteric; she was in bed a month and had diarrhœa and bloody stools. Subsequently she had hooping-cough, and about the age of ten a slight attack of measles. As she grew up the health was moderately good. She was unable to bear much excitement, which produced headache; and deviation from plain diet caused indigestion with pain in the epigastrium. The catamenia appeared at the age of fourteen, and the functions were normal up to eighteen months ago, when there was suppression and its results—headache, light-headedness, flushing heats, and pain in the back for six months; since then the flow has been regular, but scanty, and preceded and followed by some leucorrhœa.

In May, 1875, she went from home, and was engaged for about six weeks making ice; her father discovering that she

[1] She died under the care of Dr. Ashurst, of Farningham, who has kindly sent me the following particulars:—"She came under my treatment for arthritic rheumatism described as following an attack of fever. The rheumatism persisted, and was accompanied by inflammatory attacks in the pleuræ, and hepatic congestion; and she ultimately drifted into an asthmatic condition, in which she died. The heart from the first showed great feebleness, but no valvular mischief. She was very corpulent. Her father died of dropsy; her mother of apoplexy."

was living badly removed her to her home after an interval of about four months. Excepting this interval she has always resided at home, where she has been engaged in the work of the house and lived comfortably.

The last few years she has been liable, at intervals of two or three weeks, to attacks of syncope—partial loss of consciousness for some seconds, rushing sound in the head, and deadly pallor, preceded by a flush of heat, and followed by a cold sweat, during which the hands would be quite wet. Some weeks she had had two or three of these attacks.

Two years ago, *i. e.* shortly after her return home, her health began to fail, she became weak, thin, low-spirited, and for a month the fingers were successively affected with sub-epidermic whitlows. After this affection passed off the fingers gradually became cold, stiff, and hard.

In July, 1876, while at the seaside, she had some swelling of the feet, and of one leg as high as the knee. The knee and toes were red and tender, and for two or three days she could not bear movement of the knee nor get her boots on. The whole affection lasted but a week.

The following is her present condition:—The hands are very cold and hard, the fingers semiflexed and almost fixed. They are rather shiny and tense, but are not enlarged, and the integument feels as if it were of the consistence of tendon; it is impossible to pinch together a fold, or to produce a wrinkle. On favorable days the colour is sallowish-pink, but on cold damp days the fingers have a leaden hue. On attempting to close the hands the knuckles become sallowish-white, and after the greatest effort the finger-tips impend over the palm at a minimum distance of an inch. The wrists are maintained straight; flexion and extension are much diminished, but the rotatory movements of the wrist are freer. The wrists ache, and all but the gentlest movements cause pain. A fine creaking is palpable during movement, when a finger is pressed upon an extensor tendon. The finger-tips are attenuated, and the nails strongly incurved from side to side, so as to reduce the interval between the edges of the nails of the little fingers to a quarter of an inch

and to three and a half tenths of an inch in the rest. The nails of the index fingers are not so incurved, but they are coarse from previous suppurative action around them. These features are slightly more marked in the right hand.

The tactile sense is slightly diminished, the fingers cannot anywhere discriminate the two points of the compass when they are separated by an interval of two lines. (This may be in part due to disuse.)

The wrists and lower part of the forearms are always cold.

After sitting for an hour in a warm room of temperature of 58° Fahr., that of the mouth was 98°, of the right fingers 66°, and of the left 69°.

The sclerema decreases upwards, and as a distinct affection ceases just below the wrists. The integument of the forearm, however, is brawny up to the elbows, the muscles are atrophied, and the anterior aspect of the limb is flattened.

The elbow-joint is slightly affected, so that complete extension of the forearm is impossible.

The right hip-joint is stiff and slightly painful, causing her to walk lamely at times. The feet are normal, but just where the ankles escape pressure from the edges of the elastic sides of the boots the integument is firmer than normal. There is no trace of œdema, nor are any of the superficial veins enlarged.

The adipose tissue has entirely disappeared from the neck and upper half of the front of the chest. On the sides of the neck, from the level of the hyoid bone downwards to the lower border of the first rib, the skin presents the characteristic appearance described in my previous case.[1] It is due to the formation of *lineæ atrophicæ*, which take an oblique course downwards and inwards to the root of the neck, and turning over the clavicle and first rib mount upwards over the manubrium to meet those of the opposite side, thus forming a series of semicircles around the root of the neck and the upper limit of the chest in front. The skin itself is thin and pliable, and there is at present no subjacent indu-

[1] See 'Medico-Chir. Trans.,' vol. lx, p. 137.

ration. On twisting the head aside, the lineæ atrophicæ are brought out conspicuously, and apparently in relief, but really this is not so, for the finger cannot detect the least irregularity of surface. The appearance of prominency is due to strong contrast of colour, the lineæ atrophicæ alternating regularly with lines of skin which has not undergone the atrophic change, but which has received an increase of pigment. Thus there is a very regular alternation of lineæ atrophicæ and lineæ pigmentatæ, the former are of ivory whiteness and opacity, the latter are yellowish brown and of the exact tint of the hair of the head. On examination with a pocket lens both kinds of lineæ are seen to be pervaded by a coarse, meagre, network of fine hair-like vessels, the main branches of which run in or close to the borders of the lineæ pigmentatæ. The meshes of the network are oblong, and take the direction of the lineæ, the finest branches pass into the lineæ atrophicæ, where they become scant and soon disappear by attenuation. These features are represented in Plate X.

The patient herself thinks the neck has become a little browner of late, and she has noticed that on throwing back the head the skin in front of the neck is very tightly drawn. On doing so the fascia covering the mylohyoid is thrown into three tight thin cords, a central and two lateral, and the pressure upon the larynx excites deglutition.

A few fine blood-vessels are seen by the aid of a lens on the summits of the shoulders, and here and there in the cheeks, but elsewhere (as far as I have examined) they are absent; and on scanning the healthy skin of the shoulders and chest the regular pigmentation of the orifices of the sebaceous follicles arrests attention, for the surface is crowded with regularly distributed yellowish-brown, circular dots, commonly a little raised and surrounded by a very fine, radiated, wrinkling of the white cuticle.

The integument of the face is rather firm, the expression set, and rather sad, features which are not abolished by a smile. I have never seen her features in the least degree contracted; a fact which I noted in my former case, and

which occurred *pari passu* with the advance of sclerema on the face.

The mammæ are well developed. The lungs and heart normal. Of the latter the action is easily excited, but in a state of rest the pulse is from 70 to 80, and under all circumstances the rhythm is perfect and the beats equal; the systole is weak, and the first sound is rather flapping, as in conditions of debility.

The urine is normal, but poor, the sp. gr. averaging about 1012·. Last summer I once found excess of uric acid, and a copious deposit of oxalate of lime, sp. gr. 1016·5.

She is liable to heartburn, and of late she has vomited once or twice a week a little frothy mucus, sometimes sour and sometimes bitter.

The bowels act irregularly; they are usually constipated, but she is liable to diarrhœa. The tongue is clean. She cannot walk more than a mile and a half on account of aching in the hips and legs, pain in the left side, and a feeling of nausea.

When warm in bed, she occasionally suffers considerable aching pain in the hips, wrists, and palms. The condition of the hands renders her very helpless, and she is unable to turn in bed.

She is chilly, and wears a complete investment of flannel. A table is appended, showing the measurements of the body and limbs, and the weight:

Measurements—

Round the waist	. . . .	21½ inches.
„ centre of upper arm	. . .	10¼ „
„ „ forearm	. . .	7¼ „
„ wrist above and below the end of the ulna	.	7 „
„ last proximal phalanges	. .	2⅛ to 2⅜ „
„ ankle	. . . .	8 „
„ calf	. . . .	11¾ „

Weight in her ordinary clothes—

Two years ago she weighed nearly 9 stone. Last summer she was a little over this weight. At the present time she weighs 7 st. 10 lbs. 12 oz.

Such is the history of this patient. Standing alone it would appear to have no definite signification, but side by

side with the patient whose history I have recorded in the last volume (vol. lx) of the 'Medico-Chirurgical Transactions,' it is very interesting.

The exact resemblance of the two cases is remarkable Six years ago William W— was in precisely the same condition as Louisa M—. Both came to me because they were unable to close the hands, and at the same period of the disease these members were in precisely the same condition. Both had acquired a delicacy of constitution, probably from acute disease—in the one case typhus, in the other variola and enteric fever—in early life. Both had a previous tendency to syncope, and both exhibited the same condition of debility, and the same functional derangement of the stomach. Both exhibit a remarkable placidity.

To conclude, they have one complexion in common, and under the influence of the same disease the same sad fixed expression.

Both patients are here to night, and in the demonstration of this singular condition I esteem this a fortunate circumstance. As these are the only instances which have come under my observation, I have hitherto regarded the affection as a rare one, but like many other presumably infrequent diseases it may prove to be more common than I have supposed it to be.

In my former communication I have fully described the central complications of which the sclerema is, as I believe, but the outward expression, I will therefore, in conclusion, direct attention to two points; 1st, and by way of appendix to my former paper, the present condition of the first of my patients; and 2nd, the formation of the lineæ atrophicæ.

1. Those who may remember W. W— a year ago will find him but little altered. He is weaker, more emaciated, and the functional disturbance of the heart and alimentary canal is more severe, prostrating attacks of sickness and diarrhœa with severe colicky pains keep him in bed for days together. Although the radial arteries are wide and healthy, the hands have apparently reached the stage when dry gangrene is imminent. Indeed, the tips of some of the fingers are in-

vaded by a more active form of molecular death than that to which they have been previously subjected. It is accompanied by much gnawing pain. In my description of the hands, I omitted to mention the attenuation of the tips of the third, fourth, and fifth fingers, and the strong incurvation of the sides of the nails, corresponding exactly to what is seen in the other case.

2. As to the morbid process in the formation of the lineæ atrophicæ. If the neck in the more advanced case of the disease be examined with a lens, it will be seen that the ivory-like lineæ atrophicæ are, with the exception of a straggling vessel here and there, entirely destitute of blood-vessels. In the more recent case, however, the whole of the affected area is pervaded by a network of fine arteries, while no such vessels are seen in the healthy skin. It would appear then at first sight, that in the production of the lineæ atrophicæ there is an excessive vascular supply. The reverse of this is really the case: the process is one of atrophy, pure and simple from the first; there is no antecedent congestion, no hypertrophy.[1] By shrinking of the lacunæ—canalicular system and blood-vessels of the connective tissue of the corium and subjacent areolar tissue, it passes into a close, firm, bloodless tendinous structure, which by preventing the flow of blood at frequent intervals causes for a time dilatation of the blood-vessels in the alternate lines or areolæ of healthy skin. These latter receive an increase of pigment just as occurs in the delicate skin of some patients after the application of a sinapism.

The condition depicted in the accompanying illustration is therefore indicative of the early stage of the process. The streaky vessels there represented are really on their way to extinction, and when this occurs the pearl-like lineæ atrophicæ will stand out in greater contrast to the lineæ pigmentatæ.

Appendix, July, 1878.—Both patients are still in attendance at the hospital; the younger, L. M—, is but little

[1] The part was never the seat of irritation, on the contrary, there was diminution both of tactile sensibility and of temperature throughout the process.

altered. She is a trifle more helpless, thinner, and the disease is more marked in the face, the integument having become firmer, and the expresssion more set. Stiffness and some pain on movement have affected the other hip. The inner ends of the clavicles once were a little tender, and they appear to be somewhat enlarged. Once also she complained of a little aching at the root of the thumb and in the middle finger. These pains appear to be due to stiffness of the joints, rather than to a distinct rheumatismal affection. On three or four occasions she has had an attack of retching or vomiting, but only once a slight return of syncope. I have observed that she is unable to protrude the tongue, the strongest efforts only placing the recurved tip in contact with the retracted lower lip. She is not aware of any previous inability to protrude the tongue, and its forward movement is probably restricted now by sclerema of the connective tissue near it.

William W— is now 51 years of age. He weighs without his clothes only 7 st. 11 lbs., the adipose tissue has everywhere disappeared, and the following measurements indicate the degree of emaciation:—round the middle of upper arm $7\frac{1}{4}$ inches, round the calf $10\frac{7}{8}$, round the right wrist $6\frac{1}{8}$; the left is $\frac{3}{8}$ in. larger on account of a puffy swelling over the end of the ulna. The intervals of retching and vomiting are shorter, and the attacks are more severe and protracted; some weeks they occur every day. Perspiration is still profuse. The skin over the upper part of the chest remains free and supple.

In August he had a more severe attack of diarrhœa and retching than usual, causing for some days alarming prostration, and the hands were quite black. He rallied, however, and in the course of nine days was able to leave his bed. A fortnight later he had another attack which, proved fatal.

DESCRIPTION OF PLATE X.

Simple atrophic sclerema (Dr. John Harley).

Process of cutaneous atrophy in a case of simple atrophic sclerema. Louisa M—, æt. 20. The brown streaks represent the natural skin with an increase of pigment : the intervals, ivory-like areolæ or lineæ atrophicæ. Both are pervaded by a coarse network of fine hair-like vessels, the main branches of which run in or near the borders of the lineæ pigmentatæ, and forming oblong meshes, spread their finest branches in the lineæ atrophicæ, where they become scant and attenuated, and disappear.

The part of skin represented is that which overlies the right clavicle about the centre and the neighbouring integument above and below.

× $2\frac{1}{2}$ diam.

H. del. Mintern Bros lith.

Appendix to Dr. Harley's second communication on Simple Atrophic Sclerema.

September 11th.—William W— came to the hospital quite recovered from his attack, looking more cheerful and expressing himself as being better than usual; but on the evening of the same day, shortly after returning home, the sickness and diarrhœa recurred, and was followed by fatal collapse; the voice was reduced to a whisper, the extremities were cold and insensible and the hands purple. He died on the evening of the 13th and retained his clear intellect to the last.

I examined the body thirty-six hours after death. It was extremely emaciated, there had been no *rigor mortis*, and the muscles were still flaccid. The sclerema and stiffness of the wrists and finger-joints had completely passed off and there was no extraordinary lividity of the now soft and emaciated fingers. There was no trace of œdema anywhere, the skin was thin and supple, and almost every trace of fat had disappeared.

The liver, kidneys, suprarenal bodies, spleen, mesenteric glands, and pancreas were perfectly healthy. The gall bladder was contracted, and contained only a teaspoonful or two of recently secreted bile. The alimentary canal was healthy throughout, the stomach was thin and dilated, and contained, as did the intestines, a considerable quantity of watery fluid.

The costal cartilages were free from ossific deposit. The pericardium was thickened and inseparably adherent to the anterior surface of the right ventricle for the space of about

½ superficial inch. The heart was enlarged, weighing fourteen ounces. The right and left ventricles presented a striking contrast, the former being thin, dilated and flaccid, while the latter was hard and contracted, the wall being fully one inch thick, and the muscle very firm and healthy. The endocardium and valves were also healthy. A firm colourless clot extended a short way into the pulmonary artery, but excepting a minute soft clot or two, the blood was fluid, and in the left cavities also of a venous colour. Excepting the diaphragmatic surfaces, the lungs were everywhere adherent, and so firmly adherent that only a portion of the antero-lateral surface of the right could be separated without laceration; their tissue was crepitant and healthy.

The united pleuræ were thickened above and behind by cicatrix-like bands of tendinous strength and hardness. It was impossible to make a clean dissection of the surfaces even with the scalpel, and only small shreds could be torn away by the exertion of great force. The sympathetic cord of both sides, from the inferior cervical ganglion downwards, was so involved in the thickening that with the time and means at my disposal (the patient died at home) I could not make a satisfactory isolation. The blood-vessels and articular surfaces were healthy.

While the dead body thus exhibits plainly enough the cause of the so-called sclerema, it proves conclusively the insignificance, not to say the incorrectness, of this term. True there was hardening of the connective tissue of a portion of the body continuously for a period of seven years, and in some parts a consequent degeneration; but it is equally true that this hardening was merely the consequence of pressure of the fluids of the body on vessels which had lost their contractile power. The condition of the hands was for the whole of this period that of impending dry gangrene. In ordinary dry gangrene the paralysis of the vessels is due to local disease affecting the arterial walls; in the cases of sclerema above narrated it is due, as I have previously surmised, to an affection of the central ganglia.

It is an interesting fact that the condition above described

as simple atrophic sclerema may be one of the results of general pleurisy—a rare result doubtless, for I have never found adhesions so general and firm in any previous case; and a remote one also, due to progressive increase of the thickening, for the history shows that W. W— could not have had pleurisy since his attack of fever about seventeen years before his death.

The immunity of the lower extremities is now most satisfactorily explained. The loss of muscular tone in the stomach points to implication of the vagus, the gastric branches of which could scarcely have escaped. The simple hypertrophy of the heart was commensurate with the arterial palsy.

[Reprinted from Vol. XIV of 'St. Thomas's Hospital Reports.']

EPILEPSY.

By JOHN HARLEY, M.D.

The following pages contain a review of the cases, about 00 in number, which, with one or two exceptions, came nder my care in the out-patient department of our hospital etween the years 1871 and 1879 inclusively; the period of y connection with that department.

I have contented myself with following the broad out-nes of the disease, but these are so extensive that, even ith this limitation, I have compassed only a part of my vast bject. Still I hope I have done enough on the present casion to form an introduction to a more complete survey hich I propose to contribute to the next volume of our ports.

I commence with a tabulated view of my cases showing e liability of age and sex to the disease.

Age when the first fit occurred.	Number of cases. Males.	Females.
ithin the 1st year ...	5	5
tween the 1st and 2nd year	9	6
the 2nd year	0	2
„ 3rd „	1	0
„ 4th „	3	1
„ 5th „	1	1
„ 7th „	5	4
„ 8th „	5	2
„ 9th „	2	3
„ 10th „	2	3
„ 11th „	2	2

Age when the first fit occurred.	Number of cases. Males.	Females.
At the 12th year	7	2
„ 13th „	2	8
„ 14th „	2	7
„ 15th „	2	4
„ 16th „	6	11
„ 17th „	4	9
„ 18th „	7	5
„ 19th „	3	9
„ 20th „	4	3
„ 21st „	4	4
„ 22nd „	2	3
„ 23rd „	4	1

Age when the first fit occurred.	Number of cases. Males.	Females.
At the 24th year	4	3
„ 25th „	0	3
„ 26th „	6	2
„ 27th „	2	2
„ 28th „	3	2
„ 29th „	1	4
„ 30th „	2	3
„ 31st „	3	1
„ 32nd „	1	0
„ 33rd „	1	2
„ 34th „	3	1
„ 36th „	1	0
„ 37th „	1	0
„ 38th „	2	2
„ 39th „	1	0
„ 40th „	1	2
„ 41st „	1	2
At the 42nd year	1	0
„ 44th „	2	2
„ 46th „	0	2
„ 47th „	1	1
„ 48th „	1	3
„ 49th „	3	1
„ 50th „	1	1
„ 52nd „	1	1
„ 54th „	1	0
„ 55th „	0	1
„ 58th „	1	0
„ 59th „	0	1
„ 62nd „	2	0
„ 66th „	2	0
Undetermined	15	23
Total.....	146	160

The broad facts which appear on a general view of this table, are as follows :

1. That epilepsy is essentially a disease of early life.

2. That the period of adolescence is more prone to epilepsy than any other.

3. That this proneness of the adolescent period is much greater in females than in males.

4. That during the prime of life (from 26 to 50) the liability is less than half that of the adolescent period.

5. That after the age of 50 the liability still more rapidly declines, but in the case of males shows a tendency to rise after the age of 60.

But the table deserves, and will I think repay a much closer analysis. I will begin with a consideration of what might be termed the intrinsical inducements of epilepsy.

The critical periods are well known to be those when epilepsy is most prevalent. This fact is well illustrated by the present table, thus :

	Males.	Females.
1st dentition (between 6 months and the 2nd year .	14	13
2nd „ („ 6th and 12th year, inclusively) .	23	16
Adolescence („ 13th and 20th „ „) .	30	56
	67	83
21st and 25th „ „) .	14	14
	81	100

It appears from those numbers that of those cases in which ıe time of invasion was ascertained, more than half of the hole occurred before the age of 21; the proportion rising ı females to 60 per cent. If the period of adolescence be ırried to its full limit, viz. 25 years, the numbers will be 1 males and 100 females; or 61 per cent. of the former and 3 per cent. of the latter.[1]

During the full vigour of life and the commencement of its ecline—that is, from 26 to 50 years of age—there are 3 males = 29 per cent., and 33 females = 24 per cent. eyond this age there are only 3 cases in the females, and in the males, the most advanced age in the former being 9, and in the latter 66.

The influence of advanced age upon the disease appears to e opposite in the sexes. In women it decreases with the ecline of the sexual function, but in men the reverse is the ıse, and the explanation is not difficult. The exercise of the exual function in men is voluntary, and in advanced life may e undertaken when the desire is in excess of the power. he undue strain to which the nervous system is thus sub-ected is undoubtedly provocative of the epileptic condition. he numbers having reference to this matter contained in the bove table are of themselves too few to furnish sufficient ata, but so far as they go, they bear out the view which I ave stated.

It may be now interesting to ascertain the compara-ve amount of resistance to a repetition of the epileptic ttacks as exhibited by the sexes. Some information upon ıis topic may, I think, be extracted from the table, thus:

1. *Of the male patients,* there were 84 in whom the disease as of recent development, *i. e.* had not existed, in any case ɔ far as could be ascertained, for longer than a year,—*ecent cases,* for the sake of distinction, I will call them; and 2 *chronic cases.*

Of the female patients there were 111 recent and 50 chronic ases.

2. In the males the fits recurred at frequent intervals, arely so long as two months, and in no case longer than ine months, in 45 cases—*continuous cases,* as I may call

[1] The unascertained cases are too few to appreciably affect these numbers.

them. In 17 other cases the disease was interrupted by a longer interval than nine months—*interrupted cases* I will call these. Thus in one case the whole history of the disease was marked by an interval of one year, in a second by an interval of two years, in a third of three years, in a fourth by two clear intervals each of four years' duration. In the fifth and sixth case there was an interval of five years, in the seventh two intervals of six and eight years; in the eighth by three long intervals of eight and a half years, eighteen years, and five years. The next 7 cases presented intervals of ten, thirteen, fourteen, sixteen, eighteen and a half, nineteen and twenty years respectively, and the 17th and last case had intervals of freedom of twenty-six and fourteen years.

In the females there were 39 *continuous* cases, according to the above limitations, and 11 *interrupted ones;* the intervals of freedom in these being one, two and a half, three, four, two intervals of four and one, five, six, seven, eight and a half, ten, and eleven years respectively.

Reduced to percentages, and using the slightly unequal totals of 146 males and 160 females, the results appear as follows:

Males, recent cases	57·5;	chronic cases	42·4
Females „	68·9	„	31
Males, continuous cases	30·8;	interrupted cases	11·6
Females „ „	24·2	„ „	6·8

The main facts thus arrived at are that: (1) chronic epilepsy is more common in men; (2) the attacks in males are more frequently interrupted by long quiescent intervals; and (3) these intervals are very much longer in males than in females.

The first of these differences may reasonably be attributed to the greater and more numerous extrinsical disturbances to which the male sex is exposed, and the second and third to the greater intrinsical disturbances incidental to the female sex.

Leaving now the statistical inquiry, I will examine a few of the more interesting matters suggested by the cases which I have tabulated, using them at the same time for illustration, and I will introduce this portion of my inquiry with the statement of a fact observable in almost every case of epi-

lepsy, namely, that a patient having once experienced a fit is liable, after a shorter or longer interval, to a recurrence ; a solitary epileptic fit in the life of an individual is rare (*Ex.* 3).

There are two main causes for this, first, the general nervous instability or irritability which predisposes to convulsive action ; second, the *impression* left by an attack. It would appear that the nervous system having been once involved in convulsive action rarely, perhaps never, forgets it, but is more apt than before to fall into this irregularity. In most cases these two causes probably coexist and intensify the tendency to morbid action.

A repetition of nervous action, no matter whether it be of the ear and fingers in the acquisition of music, or of the morbid actions of an epileptic fit, results in acquired tendencies of the same kind, which under favorable circumstances ripen into "instinct" and "hereditary tendency," transmissible to offspring.

This law of nervous action must be regarded both in the history and in the treatment of epilepsy.

In reference to history we find that a considerable number of epileptics derive their tendency from their parents ; and in respect of treatment it may be safely stated that the longer we can postpone an attack the less is the liability to a recurrence, and *vice versâ*. A large proportion of epileptic cases show this recurrence at critical periods, and the attacks become so habitually associated with them that it is difficult and often impossible to break the connection.

Epilepsy exhibits an endless variety of phases. It ramifies into every region of nerve disorder and claims a relationship all round. In this case it seizes the body or some portion of it with an irresistible cramp, quietly and silently curving it this way or that. But more commonly the fit descends like a swollen mountain torrent, and the muscles, voluntary and involuntary, are thrown into uncontrollable convulsion. In one patient the skin is pale from insufficient action of the heart ; in another, the heart beats almost to bursting, the distended vessels actually give way, and the patient comes out of the fit everywhere mottled with blood spots.

In this case the sensation is mainly affected ; in that the

intellect. One patient, though shaken by the fit, is clear and able at once to resume his ordinary duties; another is oppressed for hours or days with sleep, torpor, or insanity, or a mixture of these.

In no inconsiderable number of cases, a weakness or absolute palsy of one side of the body accompanies the torpid state, and we cannot possibly distinguish the condition from that of apoplexy. In other cases the nerve storm is expended upon particular nerve centres, the consciousness being but slightly affected in the fit, and the patient is permanently crippled in a limb.

Sometimes the attack reduces the mind to a momentary blank with scarcely a visible effect of its occult influence, and, but for a variation in his surroundings, the patient himself scarcely knows of his mental eclipse.

Abundant illustration of these statements will be found amongst the following cases:

Imitation and fright.—The *sight* of an epileptic fit is sufficient to induce the disease in a sympathetic temperament.

Ex. 1.—Margaret M—, æt. 17, a well-nourished, strong young woman in whom all the functions were normal, was taken with a succession of epileptic fits in consequence of having witnessed a fit in the person of another young woman with whom she was sleeping. Having fallen downstairs in one of these fits she was admitted into Guy's Hospital about the latter end of 1873. After her discharge, the fits continuing, she came under my care. It is probable that the fits disappeared, for the patient soon left off attendance.

Ex. 1 *bis.*—An old friend and patient, a gentleman now in his fiftieth year—fair, and of sanguine and nervous temperament, and whose ailments have always been of a nervous character, and notably a prolonged attack of gastric pains from spasmodic contraction of the pylorus—he told me that he had when a youth an epileptic fit as an immediate consequence of seeing a lad of similar age suddenly taken with a fit in the office. My friend was unconscious and bit his tongue. This was the only attack he ever had.

Is it *fright* or *imitation* in these cases? I have no hesita-

tion in concluding that it is in most cases the former. But why may we not conclude that all have their origin in fright? The answer is obvious and satisfactory—who, for example, can resist the infection of a yawn? And if the will is insufficient to suppress a placid contraction of the diaphragm, how easily may choreic or epileptic movements reproduce their kind when the will—as must be the case in imitative epilepsy—is altogether in abeyance?

We must admit, therefore, that epilepsy may result from mere imitation.

That fright alone will produce it is a fact expressed in the household words "frightened into fits."

Ex. 2.—I once saw an instance of this. I was summoned to a gentleman who deliberately cut his throat and died instantly before a company of people in the house of a friend with whom he was staying. The hostess, a strong woman, about forty years of age, met me at the door, and we entered the room together. Glancing at the tragic scene, the lady uttered a cry and fell down unconscious in one of the severest convulsions that I have ever witnessed. This was the first fit she ever had, and it is now thirty-five years since it occurred, and she has not had another.

As to prognosis, my general impression is that when epilepsy has been caused by fright it soon disappears, and perhaps, like the case just narrated, does not occur after the first fit. This, however, is not always so, as the following will show:

Ex. 3.—Alice L—, æt. 18, had a succession of three fits in consequence of fright; after the lapse of six months she had a fourth, and during the following six months six more. What was the further progress of the case I cannot say.

In the following case the epilepsy became continuous:

Ex. 4.—Charles E—, æt. 39, was frightened by seeing his bedfellow have a succession of four or five severe fits. He had a fit the same night, and they continued to recur up to the time when he came under my care—a period of eight or nine years.

The following may perhaps be attributed to fright:

Ex. 5.—William T—, æt. 16, lost a thumb by machinery, and the same night had three epileptic fits. They recurred

about two months after the accident, previously to which he never had a fit.

Passion may be said to go half way in the production of both mania and epilepsy, and may be accepted, therefore, as a common cause of both.

Ex. 6.—Celeste M—, æt. 21, a very excitable person, had a few words with her sister, and this was followed by a severe epileptic fit typical in character. Three others had followed up to the time of her discharge.

Consciousness preserved, partially or completely, during the fit.

Ex. 7.—Sarah C—, æt. 58, has had very frequent attacks of the following kind for the last three years. The fit begins with shaking of the hands; she cannot speak, but retains consciousness and sits down; the face becomes red; occasionally there is partial loss of consciousness, but she never slips out of the chair.

Ex. 8.—Jane Mc K—, æt. 59, three months ago had an attack of numbness on the right side with loss of power in the right limbs lasting an hour. There was no loss of consciousness, but numbness and weakness of the right hand continues. Several similar attacks followed, and on one occasion she lost her voice for two hours.

Ex. 9.—Henry B—, æt. 15, has had fits of the following character for the last eight or nine months; he is taken night or day with clenching of hands, tremors, and turning to the right; loses articulate speech, but makes a crying noise; the head is drawn round to the right and fixed. Each fit lasts from four to thirty minutes, and some days he has a succession with intervals of an hour, during which he sleeps heavily with stertor. Consciousness is only lost in the severer fits. Alternate excitability and depression occur in the intervals between the fits.

Ex. 10.—Mary A. C—, æt. 32, the subject of severe epileptic fits for years, aggravated by menstruation. Only recently married, and this appears to have aggravated the epilepsy. The fits almost always occur at night and are attended by loss of consciousness. Latterly she has had in

addition day-fits. "She does not fall, and loses her senses only for a moment, then with a start everything that she can remember comes into her head, all manner of people and things, and she is terribly frightened. She dreads these attacks far more than the severer ones, and they leave her very tired." These attacks last only a minute.

Ex. 11.—John O—, æt. 10, since birth has had a tendency to fall forwards, and during the last two weeks has fallen backwards fifty times and lain insensible for two or three minutes. Some days he falls a dozen times with momentary loss of consciousness; frontal headache is a prominent symptom. Once only had a convulsive fit, it occurred during dentition, and was attended by unconsciousness.

Ex. 12.—William J—, æt. 19, has had from early childhood giddiness and falling fits, without loss of consciousness, passing at the age of 19 into severe epileptic fits with loss of consciousness and severe convulsions.

Suspension of consciousness without convulsion.

Ex. 13.—Louisa T—, æt. 28, a healthy woman with three healthy children, with no hereditary tendency to nervous disorder, after marriage, at the age of 25, became the subject of the so-called *epileptic aura,* losing consciousness, but going on with her employment. She has continued to have two or three of these attacks every day for the last three years. The day before she saw me she was in a continuous attack most of the afternoon, got tea ready and washed her three children and put them to bed without knowing anything about it. She often does not know what she says. She has nursed her three children, each about nine months; the youngest is fourteen months old. All the functions are normally performed.

Ex. 14.—Robert M—, æt. 20, for the last two and a half years has had about two fits daily, they last about a minute. Onset sudden, can just slightly feel, but cannot speak or stop the fit, which comes on in the midst of his employment. He is suddenly seen to stop and smile, the hand is raised and the fingers jerked, the gaze fixed. In a few seconds he

looks about him, meddles with anything that crosses his vision, whistles, and talks nonsense; then recovers his senses and volition and has no knowledge of what has happened to him. He has never fallen.

Evanescent insanity as the immediate consequence of the fit.

In some degree, and usually for a very brief period, this exists in a large proportion of cases. The cases are indeed exceptional in which the recovery is so complete as to allow of the immediate resumption of intellectual work. The nervous exhaustion is proportionate to the strength of the individual and to the duration and violence of the fit, and may be generally measured by the degree and extent of the somnolency which succeeds it. Where there is no great expenditure of nerve force, *i. e.* where the convulsive attack has been brief and of moderate severity, and the patient is strong and hearty, he may rise from it, feeling only a little tired and shaken. But a similar attack in a weakly person may leave him prostrate and somnolent for hours.

The sleep of the recovering patient is not the "balmy" sleep of health, but the torpor of intense cerebral exhaustion. It is like the sleep of apoplexy, often noisy with stertor and delirious mutterings. But this sleep unfortunately does not come to all, and the exhausted and disturbed brain remains awake to perverted and distressful feelings. The struggle which so lately convulsed the body is present to the mind, and in a waking dream the patient tries to carry on the conflict. Under these circumstances he is violent, resistful, and sometimes revengeful; in a word, he is a dangerous maniac.

In some degree this perverted state of the intellect exists I believe after every severe fit, but happily it is usually more or less completely masked by the sleep, and rendered impotent by the attendant exhaustion.

The following cases furnish illustrations of these statements.

Case 10 is also very interesting in reference to the mental condition, for in this instance the fit was not attended by

loss of consciousness, and the intellectual disturbance stands alone—dissected, so to speak, from the ordinary complexities of a fit.

Ex. 15.—During the past summer I found an old epileptic patient, a powerfully developed young man, æt. 22, in one of my beds in the hospital. He had had a rapid succession of severe fits, and for some hours the nervous system manifested an exalted state of irritation, indicated by hyperæsthesia and spasmodic twitching passing occasionally into clonic convulsions. After these finally ceased he remained for three or four days completely unconscious, incapable of voluntary movement and deglutition, and passing his excretions involuntarily. He was supported by nutrient enemata and gradually recovered his consciousness by passing through a delirious stage in which he required much control. He then made a rapid recovery, and in ten days after the attack felt quite well and left the hospital.

Ex. 16.—William C—, æt. 37, a strong healthy man, was taken with fits at 5.30 a.m. while dressing; before 9 a.m. he had nine severe fits, and did not recover his consciousness until 5 p.m. A fortnight later he consulted me at the hospital, and on returning home was taken with fits, and these recurred at brief intervals during the next three days. In the intervals he was alternately violent and somnolent. The fits passed off but acute insanity remained, and he was taken to Brookwood Asylum. He was discharged after a fortnight, recovered. He returned to me after some months and remained under treatment for insomnia and headache, but there were no more fits up to the time of his discharge. This case was aggravated if not caused by alcohol.

Disordered sensation.

An analysis of the disorders of sensation general, special, and intellectual, which precede, accompany (appreciable in some cases), and follow the epileptic attacks, would without doubt disclose some interesting and important relations of nerve action. On the present occasion I can offer but few instances. Few patients, indeed, are gifted with the ability

to describe correctly the rapidly passing sensations which often give warning of the coming trouble, while those which accompany and follow the fit are usually eclipsed from their minds.

Ex. 17.—Anne P—, æt. 30, two last years epileptic, the fits being preceded by heaviness and numbness on one side, chiefly the left, or from the feet to the head, lasting five minutes. The disorder of sensation occasionally came on without being followed by a fit.

Ex. 18.—Isabella J—, æt. 30, married, has had two attacks of numbness of right foot running up the leg to the neck and head, lasting five minutes. Occasionally has a sensation of heat at the back of the head and over the eyes, and a disordered (diminished) sensation of the tongue. No loss of consciousness.

Ex. 19.—Amelia L—, æt. 49, had had a fit with loss of consciousness seven months before, and was paralysed of the left side for a month afterwards. Weakness of the left grasp still remained and she could not hold anything with certainty in the left hand, the thumb of which was drawn to the palm ; the left side of the mouth was tucked up, and the tongue deviated to the right ; the pupils were equal. She consulted me for attacks of numbness of the left side becoming very complete. One to four of these attacks would come on in the day. Occasionally there was working of the left arm, and she began to stutter and was obliged to lie down. Afterwards, whether the attack was of this nature or simply one of numbness, she was very drowsy.

Ex. 20.—Sarah A—, æt. 49, after being much troubled with vertigo for a year, had an epileptic fit. On recovering consciousness she felt as if something had "gone off" the side of her face, and she has had numbness of the left side for several days. Some twitching of the facial muscles on the left side remained, the tongue deviated to the left, and the limbs of this side were weak.

Ex. 21.—Sarah T—, æt. 52, has attacks of tremor. She also has attacks of numbness, beginning in the feet, ascending the limbs and body to the side of the face and head. She then falls, but does not lose consciousness.

In many cases a feeling of numbness overspreads the head.

In others a sense of flushing runs upwards from the hand or foot to the side of the head.

Case 10 affords the only description of sensation during the fit which I am able to adduce from the present list.

Disorders of motion.

Ex. 22.—Elizabeth P—, æt. 41, had slight epileptic fits during the last month, each lasts about fifteen minutes, beginning with defective speech and staggering, and is not attended with much convulsive movement. There is much heaviness and somnolency after the attacks, and the right arm is much weakened by them. The pupils are unequal, the left being the larger.

Usually there is complete paralysis on the oncome of the fit, the patient falls suddenly and often without the faintest warning. The following illustrates the earliest phase of this condition in the *petit mal.*

Ex. 23.—Mary C—, æt. 44, had had for the last three months two or three attacks of giddiness daily, during which she was obliged to hold on to any support to prevent falling. Consciousness was unimpaired. The left leg was a little weak.

This case will compare with that of Louisa T—, *Ex.* 13, in which consciousness was abolished, while co-ordinated and apparently voluntary motions remained.

Left hemiplegia appears to have been the result of an epileptic fit in two other cases, Amelia L— (the case is given under disorders of sensation, *Ex.* 19), and Sarah A—, *Ex.* 20.

See also Case 40, p. 199.

Partial paralysis of tongue and loss of speech (hypoglossal paresis).

Ex. 24.—Henry H—, æt. 13, had a fit, fell, and was insensible, but was quite still for a quarter of an hour. Since then, and up to the time he was last seen by me, a period of twenty days, he was quite speechless, could not open the mouth wide, nor protrude the tongue. There was some diffi-

culty in swallowing fluids, and the deglutition of solids was very slowly performed.

Six months previously he had a fit, but this did not affect the speech or leave any notable effects.

Absence of speech is an occasional effect of the epileptic condition. The following are instances.

Ex. 25.—Alice W—, æt. 13, at eight months of age had the first convulsive attack, which lasted for three or four hours. At the age of seven years she had a second attack, still more severe and prolonged, and was not expected to recover. The third attack occurred six months later, and the fourth at the age of nine years. These three attacks were also very severe. Since the fourth she has been free from fits, but she has continued liable to attacks of excitement when crossed. She has never been able to converse, her speech being confined to the following words, "Yes," "Good," "By," "Poor;" spoken at intervals of days or even weeks.

She is a particularly healthy, well-developed child. She sleeps well, but complains of headache occasionally. Her only other ailments have been rubeola and pertussis.

I prescribed a mild interrupted current to the nape and front of the neck, and hemlock juice to quiet the liability to mental excitement, in doses rapidly increased from ʒiij to ʒxij, once or twice a day according to need.

During the few months she remained under treatment there was a decided decrease in the number of the attacks of excitement, and she was reported to have made the combinations "Come on," and "Give me one" during this time, having spoken only monosyllables previously.

The following is another instance, loss of speech in this case being a part of the infantile paralysis.

Ex. 26.—Ellen W—, æt. 9, had severe fits during dentition, and they continue up to the present age at intervals of three months. She is strongly convulsed in the attacks, which last for three or four hours. After sleeping three or four hours more, recovery is complete.

She has never walked, the right knee is a little contracted; she uses the left hand, and the right only for pulling. Her

speech is limited to a few words, and she has said "Bless my soul," "Here, here."

She appears to be lapsing into idiocy, her bonnet strings are wet with overflowing saliva.

Her mother had a slight fright at the sixth month of gestation.

Frequent repetition or violence of the attacks will sometimes produce complete exhaustion of the nervous system and death, thus :—

Ex. 27.—A powerfully-developed, and apparently healthy young man, about 24 years of age, was admitted into King's College Hospital in a convulsed and unconscious condition. The convulsions were chronic, violent, and equally distributed, and occurred at frequent intervals. He was profoundly unconscious. In the intervals, the muscles were flaccid and the pupils equal. The excretions were normal. He died the same day without further change.

The post-mortem examination revealed nothing but slight thickening and opacity of the arachnoid.

Ex. 28.—Again : A girl, æt. 14, had been afflicted with epilepsy for about a year; the fits increased rapidly in frequency and severity, and in one of them the patient died. A small tumour the size of a pea was found attached by a short stalk to one of the superficial veins of the right corpus striatum. It proved to be a cisticercus. There was no appearance of irritation, much less of inflammation in the neighbouring nerve-tissue.

Epileptic hemiplegia including infantile paralysis.

I now call attention to these permanent results of the epileptic attack. I hope hereafter to resume this interesting branch of the inquiry, and I believe I shall have no difficulty in proving that both permanent hemiplegia and infantile paralysis often result from an accidental overflow of nerve force of such intensity as to permanently damage the conducting motor fibres. Temporarily, hemiparesis or hemiplegia is present in many cases.

The following is an instance of permanent hemiplegia:

Ex. 29.—Esther F—, æt. 34, a healthy and intelligent woman, liable since her marriage to slight epileptic attacks. A week after her last (5th) confinement, from which she was nearly convalescent, and while drinking her tea and joking with a neighbour, dropped the cup from her hand and was seized with one of her usual attacks, a succession of them followed. She regained her consciousness in an hour, but on doing so discovered that she had lost the use of her left limbs, and the mouth was drawn to the right. She was admitted five weeks after the attack. The left arm and leg were completely paralysed, and the fall gave slight indications of pre-existing palsy of the left side. The mind was clear, she was cheerful and bright, and the functions were all normal. The leg speedily, but only partially, recovered, and she was able to leave the hospital seven weeks after admission. A month afterwards she had another fit similar to the one which caused the paralysis.

A year after the attack she was able to walk half a mile, but there was much dragging of the leg, and the arm remained completely paralysed, the fingers flexed and contracted. Under the influence of bromide of potassium a recurrence of the fits has been so far prevented.

Ex. 30.—Mrs. M—, æt. 64, lost the use of her right side and speech after her first confinement, in consequence of one of her usual fits. Now, after an interval of forty years, the right hand is closed and contracted, the elbow rigidly flexed at right angles, and she cannot raise the arm. Can walk only a few hundred yards, and drags the right leg. The tongue is protruded readily and straight, but she can only say a few words, "Um, um, O yes, tired, John, me, mine, Mas on" (her name). She is perfectly intelligent, and has the full use of the other senses; she does not even wear spectacles; the pupils, however, are unequal.

Ex. 31.—Henry G—, æt. 28. Had his first fit two years ago. It was followed by paralysis of the right side, and he was in St. George's Hospital under Dr. Barclay two months in this condition. He pefectly recovered the use of his side, but has had a return of the fits lately.

Ex. 32.—Cordelia S—,[1] æt. 4½, a strong, bright, intelligent child. At the age of two years she fell on her head and lay insensible for two minutes, a slight scar on the left temple is the result of the accident; at this time dentition was completed. Seven weeks afterwards she had a rapid succession of seven severe fits within three hours. This attack left her powerless and speechless. There were no febrile symptoms, she lay composedly, and apparently recovered, but the right limbs were powerless, and the only word she spoke was "tea." She had no more fits for a year, they then returned, and she had one every day, but they were less severe. After continuing for two months she had an interval of freedom for four months, the attacks then recurred as severe as ever, but more frequently, having as many as nine in the twenty-four hours. They continued for the next three months, during the last three weeks of which time she was under treatment. They last two minutes, and the right limbs are more convulsed than the left. There is slight atrophy of the muscles of the right limbs. Under the influence of conium in large doses a rapid improvement took place, and in the course of three months she was able to walk with a considerable drag of the right foot, and could raise the right arm above the head; her vocabulary increased and her speech became more distinct.

Ex. 33.—Alice H—, æt. 7, became the subject of partial idiocy and general paralysis, the result of frequent, but not severe epileptic fits (sometimes as many as twelve a day). The fits appear to have been caused by a fall on the head at the tenth month of age.

The following is a marked instance of the *paralysing effects of epilepsy, with a gradual and prominent impairment of voluntary power; and also of death from exhaustion produced by an attack.*

Ex. 34.—Agnes S—, of dark complexion, well-developed and of good general health, died at the age of thirty after an epileptic fit. She was not so much convulsed as usual in the attack, but remained completely unconscious and without movement for fifty hours after it. As usual the left

[1] This case is recorded at length in vol. lvii, 'Medico-Chirurgical Trans., p. 126.

side of the body was the more convulsed, the face being drawn to the left, and the eyes closed.

The following is her history: She had gastric fever between 14 and 15, at which latter age she experienced her first fit—as a result, it seemed to her parents, of the gastric fever. The fit was a severe one, but she recovered consciousness after two hours. During the following year she had several slighter attacks, but for the next two years, from 17 to 19, was quite free from them.

She married at the age of 19, and during the next nine years gave birth to four healthy children, three of whom are living. Shortly after marriage she had another fit, and during the next seven years three others, all at pretty regular intervals and all very severe, attended by prolonged unconsciousness and followed by marked weakness of the left limbs and of the muscles of the right side of the face, effects which nearly passed off before the return of the next fit. The weakness of the left leg, however, was increased by each attack. About this time she came under my care, five years before her death and seven years after marriage. The left leg had been weak for four years, and two years previously the left side of the face was paralysed for three weeks, and at this time, probably upon a suspicion of syphilis, which, however, never existed, she was salivated. The fits were now recurring every six or twelve weeks, the convulsions being more severe, the after effects more prolonged, and the intervals too short for the recovery of the hemiplegic weakness.

She presented a healthy appearance, but rather a heavy manner, and could attribute her fits to no cause except depression of spirits, which was evidently nothing more than an effect.

She now walked with difficulty, requiring support and dragging the left leg; there was no wasting or spasm of the muscles, no diminution of sensation, nor any trace of facial palsy.

During the next three years the intervals of freedom from the fits were longer, the average duration being about four months. The attacks, however, increased in severity but not so much in convulsive movements as in the after

effects, the unconsciousness attending them being profound, and extending to twenty-four, thirty-six, and forty-eight hours.

At the end of this time she was unable to walk, being wheeled about in a chair. Very little voluntary power remained in the left leg: to use her own description "The left leg stood out, and she could not get the right one down; the knees were weak and achy and there was a frequent sensation of needles and pins in both legs and feet, but chiefly the left." There was no loss of sensation nor wasting of muscles. The tongue usually deviated to the left, and the right pupil was always slightly the larger. The memory and vision were both, she thought, getting weak.

In one typical attack which I witnessed in the hospital she lay completely paralysed, with relaxed sphincters, and unconscious for nearly three days, and then began to return very slowly to sense and motion, but the limbs were flaccid and powerless for several days.

At this time, two years before her death, she conceived her fourth child. During the second month of gestation she had a fit, but went the remaining period and four months longer without any return. A healthy child was born at the normal period. She did not nurse. This long freedom (eleven months) from an attack resulted in marked improvement. The sight and memory were better and she could again walk across the room with assistance.

Four months after her confinement she had another fit, very severe, the convulsive stage lasting six hours, and the unconscious state for twenty-four hours longer. Seven months later on, and when a little improvement had taken place in the use of the legs, another attack came on, unconsciousness continuing for thirty-six hours. After this she was never able to walk or stand, and was lifted in and out of bed, and had scarcely any feeling in her legs.

The general health continued good and she became stouter; there was, however, no reappearance of the catamenia from the time of her confinement.

The fits now increased in frequency and she became more and more lethargic and weaker, the unconsciousness after each succeeding attack being so profound and protracted that

it seemed doubtful on each occasion whether she would recover.

This case is a notable one, serving as it does to explain much that we see in epilepsy. The disease was at first one of ordinary functional epilepsy, beginning with the menstrual nisus, increasing in severity and causing a partial degeneracy of nerve-cells, corresponding and proportionate to the amount of paresis. A *partial* degeneracy undoubtedly, for we have evidence up to within two years of her death that the temporary paralysis and subsequent paresis were the direct effects of the convulsive attacks, and that when these were postponed for a sufficient length of time the muscular and mental weakness diminished to such an extent as to make it conclusive that if the intervals between the fits could have been sufficiently prolonged recovery would have been complete.

As far as my observation goes, hemiplegia is a frequent result of epilepsy, whether from complete exhaustion and subsequent degeneration of the nerve-cells, or from some obscure lesion taking place at the time of the fit[1] is uncertain.

Influence of pregnancy and the puerperal state in the production of epilepsy.

A consideration of Case 34, in which the pregnant state appeared to be inimical to epilepsy, induced me to look through the cases in the present table with the view of ascertaining the effects of pregnancy and the puerperal state on the production and recurrence of the epileptic attacks. The following are the results:

A. *Pregnancy.—Ex.* 35.—Mary Ann G—, æt. 40, had the first fit at the age of seventeen, shortly after marriage, and when she was pregnant of twins. During the next twenty-three years she gave birth to seventeen children, eight of whom were twins. She had during this time a severe fit, lasting from a quarter to half an hour, every three,

[1] We know that a conductor becomes ruined when its sectional area is greatly disproportionate to the amount of electricity to be transmitted. The nerves are mere conductors adapted normally for the convection of moderate currents, and it is reasonable to suppose that the violent explosions of nerve force which generate the convulsions may in like manner act injuriously upon the delicate conducting fibres without producing, for a time at least, any evidence of lesion.

four, seven, or fourteen days. The general health remained good, although she was usually affected with either leucorrhœa or menorrhagia.

As a rule the fits, in a confirmed epileptic, are increased towards the end of pregnancy. The reverse, however, was the case in Case 34, p. 17.

Ex. 36.—Elizabeth C—, æt. 33, had epileptic aura, momentary forgetfulness, two or three times a day during gestation, and subsequently developed distinct fits.

B. *The puerperal state.—Ex.* 37.—Elizabeth D—, æt. 21, had her first attack two weeks after the birth of her second child, which she nursed, and they have continued almost every day since, a period of seven months. Each fit lasts ten minutes, there is no loss of consciousness, and the convulsive movements are confined to the left side of the face and the left arm.

Ex. 38.—Emily B—, æt. 47, the subject of severe attacks, the first of which occurred, at the age of twenty-nine, a week after delivery.

Ex. 39.—Ellen E. B—, æt. 30, aborted about the second month and had much flooding. Three days after this ceased she had her first fit. There was no evidence of syphilis.

Ex. 40.—Sarah T—, æt. 40, had epilepsy in childhood, but not again, until she was in the fifth to sixth month of pregnancy. Then walking out in the hot July sun she fell down in a fit, and was insensible for three and a half hours. On recovery, and since—a period of nine days—the right hand has been weak, and she halts a little on the right leg.

See also Case 29, p. 16.

I will not draw any conclusion from these examples on the present occasion, as I shall be able to adduce many more from my private cases, and I hope to resume the subject at this point next year.

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LUMLEIAN LECTURES

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BY

JOHN HARLEY, M.D.Lond., F.R.C.P., Etc.

FIRST LECTURE

The disease which I have selected for consideration in the lectures which I have the honour of delivering to this College is one of vast interest and importance, for it knows no local bounds, flourishes equally well in the crowded city and in the open country, and lays low alike the strong and the weak, the rich and the poor.

History deplores that which should give encouragement to the advocates of peace; for whenever a nation selects her hardiest and healthiest sons, and sends them, ever so well provided, upon a military expedition, many more succumb to disease than are destroyed by the enemy unless the strictest attention be paid to sanitary necessities. Indeed, in the past, patient and politic commanders have sometimes been satisfied to entrust the disorganisation and destruction of an opposing army solely to the sure and unrelenting hand of disease—disease indeed of many forms, but when we come to classify them, we find those affecting the intestines to be by far the most numerous and important.

Although the subject of enteric fever was discussed in

this place so recently as nine years ago by my esteemed friend Dr. Cayley, I felt that, as our views upon some matters were widely divergent, I might venture to bring the subject again before the College.

In doing so I propose first of all to search for its origin; then to trace its associations and relationships with other diseases, in further illustration of its origin; and lastly, to call attention to its treatment.

The materials which I shall use for this purpose are the cases of enteric fever which have come under my care in St. Thomas's Hospital during the last ten years; and those whose histories are given in the medical reports of the War of the Rebellion in the United States of America, as far as I may be able to use them in the brief course of the Lumleian lectures.

In considering the ætiology of enteric fever I shall not confine my inquiries to a narrow field, but shall be prepared to find a variety of influences accidentally combining to produce the same result—the development of enteric inflammation.

In reference to one set of conditions, we are well assured that filthy air and filthy food or drink are producers of enteric fever.

Inferentially we may certainly go a step further, for if filth from without will produce the disease, it may be safely conceded that filth generated within—*intus et in cute*—will also produce it.

In brief, the cause of enteric fever may, even in respect of this one set of conditions, be either intrinsical, or extrinsical.

In considering the intrinsical source of enteric fever, it will be necessary to study that variation of external conditions which may have produced such internal derangement as would constitute the intrinsic cause, and this I will attempt to do further on.

Science, however, is not satisfied with generalities, but seeks to know the immediate cause, to isolate the simple factors, and then to ascertain how these can set

up a specific morbid action. The more, however, the view is narrowed, the greater do the difficulties become.

Granted, for example, that this water which has filtered through cesspools a little higher up the valley is the cause of an outbreak of enteric fever in the village below, what particular constituent of the fluid is it that produces the disease? Is it a chemical compound, or is it an organised body?

If it be the former, it exists in such tenuity that the chemist fails to detect its presence. If it be the latter it is a microscopic dot. It must be conceded that micro-organisms exist in the clear limpid sewage filtrate which causes enteric fever, and also that they abound in the stools of patients suffering from this disease. But what of these?

Within the last few years the influence of these micro-organisms in the production of disease has engaged the attention of a large number of observers. They have pursued this attractive study with an ardour which has never been exceeded in the progress of medicine.

In an incredibly short space of time they have penetrated the profoundest depths of knowledge, and have unfolded those mysteries of disease which have engrossed the attention and perplexed the wisdom of the generations of medical observers who have gone before us. They have isolated and exposed to our wondering gaze the concrete essence, the absolute and visible germs of vaccinia, of variola, of diphtheria, of tubercle, of syphilis, of cholera, of enteric fever, and, indeed, of almost every other important disease; they have employed their leisure in cultivating these dreadful germs, and they handle them with a freedom and impunity that the cobra charmer might envy.

It is interesting to witness the effect of these astounding revelations.

The novelty and the simplicity of the discovery, and the complete absence of everything like doubt or hesitation in the announcement one after another of these discoveries,

have made an easy and rapid conquest of medical opinion; and at the present time the bacteriological laboratory is a necessary adjunct, not to say an important department, in all the more advanced of our medical schools.

In one little field of vision we may there see, side by side, the germs of almost every disease; and the medical tyro readily enumerates the distinctive characters of each of these seeds of woe, while he attributes to each its specific power.

But our admiration is not allowed to stop here. It has been shown that these agents may by successive cultivation be robbed of their fatal power, and brought into beneficent subserviency to living beings. "It is possible to obtain cultures of such a low degree of virulence that when inoculated into the skin only a local effect is produced; but the animal survives, and is then protected or 'vaccinated' against the more virulent material" (Klein, 'Micro-organisms and Disease,' p. 95).

Yet further and more wonderful than all, a microbe thus tamed by culture—thus robbed of its fiendish power, and converted into a ministering angel—may be set on the track of an incubating disease, and it shall arrest even rabies in its baleful course, and having arrested, annihilate it.

Such are some of the surprising results of our very brief acquaintance with micro-organisms. When we know them better, and can consult their proclivities, direct their antipathies, regulate their interactions, and, it may be, utilize their very gambols, who shall presume to say that we have not passed the "winter of our discontent," and reached a point from whence we can descry a happier future for man and beast?

Such discoveries as these, when they are duly appreciated by a grateful people, should at least lead to the rehabilitation of the temples of Æsculapius, and secure for his followers such honours as no other profession has yet attained to.

But while a goodly number of intelligent observers, impelled by enthusiasm unrestrained by caution, are

attracted by the glare of these splendid discoveries, there are others of a slower and less credulous temperament, who, while they yield to none in their desire for truth, would have every observation leading to its elucidation tested with the most scrupulous care, and rendered unassailable on every side. To minds of this mould, objections present themselves which have been overlooked or but lightly regarded by the other class of observers.

The *first* consideration which presents itself is this: that the healthy body is endowed with a superabundant store of vitality which enables it to resist the encroachments of the lower vegetable organisms; that it is only when a depression of this force, sufficient to place the individual in a condition very near its extinction occurs, that the body is liable to their invasions. This is well illustrated in the development of thrush in phthisis, where we can detect a point below which the vitality cannot sink, without a liability to the invasion of the fungus. And what is true of the body generally is true of any part of it. If in any restricted region, either of a parenchymatous organ or of the connective tissue, a local depression of vital force occurs, there the animal fluids, released from the protective influence of that force, will become liable to spontaneous change, and the development of putrefactive organisms.

Secondly, time is a very necessary condition for the development of micro-organisms. In the sudden transition from health to disease, such as we occasionally witness in almost every acute disease and most frequently in the rapidly fatal cases, there is no time for the growth and general dispersion of micro-organisms. A patient, for example, may die of cholera two or three hours after invasion. We have no knowledge of a rapidity of growth of micro-organisms at all proportionate to this result—a rapidity which is comparable to the effects of snake-poison, or to a general displacement of the oxygen of the hæmoglobin.

Thirdly, in the production of a given disease—anthrax for example—by inoculation, it must not be forgotten that

something else besides the bacilli is introduced, to wit, *the animal fluid* in which they float.

It is, indeed, assumed that repeated cultivation for several successive generations in suitable media outside the body will clear the organisms from every kind of matter derived from the animal body from which they were originally taken. This may be doubted, but according to the admissions of the bacteriologists themselves, the bacillus in some cases is rendered harmless by this dissociation of the micro-organism and the animal fluid.[1]

Fourthly, the presence of the bacillus and its congeners in a given fluid may be taken as a proof of the putrescent character of that fluid, and such as when introduced into the body would generally be capable of exciting morbid action; and it is, I maintain, the putrefying fluid and not the bacillus which is the cause of morbid action in the blood and tissues of the body. Generally it may be assumed that the bacillus is the scavenger and innocent agent whereby a putrescent fluid is converted into a pure and harmless one. In some cases, like that of the bright, sweet water which has been contaminated by excretory filth, and that which has been more or less saturated with sewer gas, a deleterious fluid comparable with the serpent's poison; or that of pure water containing but a trace of hydrocyanic acid, may be generated.

The formation of cyanogen by the fusion of refuse animal matter with potash is a fact of the greatest interest in reference to ptomaine poisoning, and investigations in this direction might very well take the place of the industrious cultivations of innocent germs.

To recapitulate: in the reproduction by cultivation of those germs which are said to retain their virulence, no attempt has been made to distinguish between the action of the micro-organisms themselves and that of the attendant fluid. *The germ is all along assumed to be the poisonous agent, whereas it remains to be proved that, apart from the attendant fluid, it is so.*

[1] 'Micro-organisms and Disease,' Klein, p. 95.

It might be argued that such a distinction is of no practical value, because a given bacillus will in a suitable medium always develop a fluid of identical chemical and physiological properties. But even if this were granted, it by no means follows that all the changes in an animal fluid are the result of bacillary growth. The deleterious properties of these fluids may be due to other causes, and in order to solve the question we must at least know the properties of the fluids formed under the influence of bacillary growth.

To assume then, as the bacteriologists do, that it is *micro-organisms and not the fluid* which produce a given result after inoculation, is to exclude one-half of the facts from the argument, and it may be the more important half. But any way, it is quite as fair to assume that it is the animal fluid, and not the micro-organism, which is the active agent. Strychnia, aconitia, atropia, hydrocyanic acid, snake-poison, and chloroform act without the intervention of micro-organisms.

The office of these latter may in the present state of our knowledge be assumed to be a beneficent one, namely to aid in the disintegration of effused solids in order to facilitate their removal from the body.

From the foregoing considerations I think it unreasonable to assent to the germ theory of disease, and I can only regard it as another of the many instances in medicine, and out of it, where cause and effect have not been discriminated. Setting aside, therefore, the germ theory of disease, I shall now endeavour to prove that the disease under consideration is merely the effect of derangement of function.

I trace those variations of health which constitute disease to two causes, acting either separately or together, viz :

First a variation of the external conditions of life, and

Secondly, a diminution of the oxidising action of the blood, either from some fault of the hæmoglobin, or of the protoplasm to be oxidised.

Given pure air, an equable temperature and moisture, and muscular exercise proportionate to the nutrition of the body, the living being is attuned to the conditions of his existence, the fire within burns steadily and cheerfully, and the products are normal and porportionate in amount.

Let disproportion now arise in any one of these conditions and an abnormal, and, so far, morbid state results. Within certain limits the healthy body can accommodate itself with facility to considerable variations in the external conditions, and those are the delicate who cannot readily do this, and who in the transition process are liable to develop abnormal action, or in other words disease. These are truisms which in the present phase of medical thought will bear repetition, and, as I hope to show further on, they are very applicable to the subject which we have under consideration.

In a large community there are many persons possessing identical constitutions, and of these there are, at any given time, some who are in an identical state of body. Granted, for example, that there is a common impairment of the digestive function, indicated by anorexia and constipation, with a corresponding depression of nutrition and of nerve power in a given number of people. In this state they are simultaneously exposed upon the same soil to the heats and chills of an autumnal day. Now is it not in accordance with what we know of the regular operations of the body to expect that in such a case the results should be identical? I think we are bound to admit that, in the main, they would be so. Further, in such a case it is both unnecessary and unreasonable to assume contagion, each case of illness being an instance of the spontaneous origin of a distinct set of symptoms common to all—the necessary outcome of the reciprocal play of definite intrinsic and extrinsic conditions.

The following apt illustration of the foregoing occurred in my own family:

One bright spring day (May 24th, 1884) I took my children for a walk across the hills and valleys between

Caterham and Woldingham. We were at one time distressed by the heat of the sun, which in sheltered situations was very great, and at another chilled by a keen north-east wind. After a long ramble we returned towards the station, and being very much athirst and short of time we called at the confectioner's and each drank some soda water. All returned home in good health and spirits, having enjoyed the excursion, but the train was a late one and the night was very cold.

Three days afterwards one of the six children, a girl, aged 8, felt poorly on rising but walked to school, where she was taken with sickness and then brought home. Anorexia and languor followed, and next day icterus was observed. This increased from day to day until the bile disappeared from the fæces. At the end of a month she was convalescent, and at this time her sister, who is a year and a half older, was also taken with sickness shortly after reaching school and was brought home. Two days after icterus was fully declared, and, as in the former case, became complete, but was accompanied by diarrhœa, with bilious stools and occasional colic. She was convalescent on the sixteenth day. In neither case did the temperature rise above 99·5° F.

The two younger children escaped with a slight catarrh, the two elder altogether. The two invalids both before and during their illness occupied different bedrooms; the first affected slept alone, but the elder girl slept by the side of a younger sister. There was no illness at the morning school they attended. The difference between the two cases is characteristic of the two individuals, who of all my family are nearest allied in constitution; the younger is quick and impulsive, the elder thoughtful and deliberate, and at that age she was liable to diarrhœa.

The most remarkable feature in the history is the length of time—a whole month—which elapsed between the disturbance and its effects in the case of the elder. In this particular the case resembles one of ague, in which

the symptoms are developed many weeks after the patient has left the locality where the disorder was received.

It would be interesting to inquire into the relationship which doubtless subsists between such cases as these and intermittent fever; but as this subject will be discussed further on, it is sufficient for our present purpose to adduce them for the purpose of showing that a combination of certain intrinsical and extrinsical conditions will produce similar morbid states in different individuals, and that in such cases the idea of contagion need not be entertained.

But as the question of contagion often arises in respect of enteric fever and its congeners it will be necessary for me to say a few words on the subject.

There are two diseases—syphilis and variola—in which we recognise a specific poison, capable, when inoculated, of reproducing its kind.

This fact has taken such a tenacious hold upon the mind that, whenever one or other of these diseases presents itself, we have no hesitation in concluding that it has originated in contagion.

If it should be suggested that the disease has arisen *de novo* the idea is not entertained. The medical man will trace the contact, it may be, a hundred miles away; or he will refer you to a fragment of clothing worn by a sufferer from the disease, and carelessly thrown aside a year ago. He will be satisfied with evidence that will not bear criticism, but he will not acknowledge the possibility of the disease arising *de novo*.

To my mind this seems very superficial and unreasonable, for it denies the uniformity and universality of the laws of nature.

Contagion is certainly a very notable fact, and it will always be tedious, and until our knowledge is greatly enlarged, very difficult to trace the source of a given disease through, it may be, several obscure stages and in different animals, but it is nevertheless undeniably true that the conditions of life are such as they have always been, from whence it must follow that their results are

the same also. And there is another argument in favour of the spontaneous origin of contagious disease: If on the one hand variola and syphilis have had their origin in a remote age, and have been conducted to us through a vast succession of contacts, how has it succeeded in preserving its virulence, since Nature never relaxes her efforts to dilute and eliminate everything which causes a deviation from the healthy standard? Or on the other hand, being so thoroughly inoculated, why not immune? Have any of us acquired this desirable condition?

By the practical denial of the spontaneous origin of such maladies as measles, scarlet fever, enteric fever, etc., our sanitary precautions will often be insufficient and misleading. It is too much the fashion to blame some distant dairy, when the truth might be known by laying bare the soil of the basement, or by subjecting the cistern or even the larder to a careful scrutiny. How often do we enter a well-appointed house, but lately built upon the virgin soil, to see a patient ill of diphtheria, scarlet fever, enteric fever or pneumonia, and in the sewer gas which pervades the house sniff the cause of the disease as soon as we enter the hall? We think all people mortal but ourselves, and for the same reason I presume regard our own surroundings as free from danger, in spite of most unmistakable evidence of the contrary. For the reason which I have stated and illustrated in the earlier part of my lecture, endemic disease is continually apt to be regarded as contagious, and this is particularly the case with enteric fever. Twenty-five years ago it was regarded as non-contagious, but now there is a very general tendency to assume it to be contagious. In his report of the Metropolitan fever and smallpox hospitals at Homerton for the year 1879 Dr. Collie makes the following statements:

"The most important point in the history of the hospital is the continued occurrence of enteric fever amongst those who nurse the enteric sick—four of such cases have occurred during the year. Believing as I did at one time

that this fever was not contagious, I thought that something was wrong with the drains. They were examined and appeared to be in excellent order, and there was no more deposit on the ward drain-pipes than would have resulted from the passage over them of clean water. The drain hypothesis therefore did not explain the phenomena, and in seeking for another we came to the conclusion that our cases were due to personal contagion, inasmuch as, with one exception, they occurred among persons in direct contact with the enteric sick, whereas persons not in direct contact with the enteric sick, but who were more or less exposed to a possible sewer-air contamination, escaped."

While I quote this statement to illustrate the present tendency to refer the origin of enteric fever to the alvine dejections of patients suffering from the disease, I am compelled to say that I regard the evidence adduced by Dr. Collie as inconclusive. He tells us that the ward drain pipes are clean, but these are only a portion of the system, and in the concluding paragraph of his report a possibility of something wrong in the construction of the drains is implied. Indeed, in the body of his report Dr. Collie admits "a possible sewer-air contamination," and as he omits to say anything about the ventilation of the drains the defect may lie here, and if so the passage of 4000 gallons of water daily through each of the ward pipes would produce a large displacement of sewer gas into the building. He says indeed that the closets and bathrooms were free from offensive odours, and in doing so probably does not use the term "offensive" in a restricted sense; but it is certainly easy to err in our estimate of the amount of sewer gas in the air. A large proportion may be present and yet many persons would not say the air was offensive. It is usually imperceptible to those confined to the house, and not always appreciated by those who come in from the outer air. But the most perplexing part of the report is contained in the following words: referring to the four cases of enteric fever arising

in the hospital, Dr. Collie says: "The incidence of the fever was not upon those who would have been exposed to drain effluvia had such existed." But I ask who in the hospital could have been more exposed to drain effluvia than the nurses who were attendant upon the enteric cases? Who could have paid more visits to the closets than these?

The following case, which quite lately occurred to me in St. Thomas's Hospital, furnishes, I think, stronger evidence of the direct fæcal convection of enteric fever than that contained in the above report:

Louisa L—, aged 19, a well-nourished domestic servant, was admitted in December, 1888, with chronic gastritis and anæmia—for one of those numerous cases the symptoms of which you, Mr. President, have with so much reason attributed to absorption of retained fæcal matter.

The previous six months she had had sickness after food, and at the time of her admission could not retain solids. The bowels were habitually and severely constipated.

At the end of a fortnight she was allowed to get up. She was still in a weakly state, but voluntarily assisted in the light work of the ward. On the 30th day after her admission and when she was about to be discharged she was taken with enteric fever.

During the preceding month the pulse was normal and the temperature normal and subnormal, 97° F. being as often recorded as 98°. On one occasion it rose to 99°, and in the same period of time there were only sixteen actions of the bowels, and almost all of them were induced by simple enemata.

The enteric attack began with headache, sore throat and a troublesome cough, temperature 100·2° F.; the fauces were congested, and the abdomen was rather tender. On the 10th day there was a copious eruption of rose spots; the temperature rose on the 3rd day to 103·2° F., and for the next eleven days obtained a maximum above this, being on the 7th, 8th, 11th, 12th, 13th and 14th day 104° or

104·2° F ; it then gradually declined and became normal on the 35th day. The attack was a severe one, and presented very typical symptoms. Like most of my cases at St. Thomas's there was constipation throughout, requiring the frequent use of enemata, and in this case the number of stools with this assistance being only thirty-one in 63 days. On the 18th day an abundant purulent discharge from the right ear appeared, and continued for 44 days. Convalescence in all other respects was established on the 48th day.

For a fortnight this patient lay in the end bed of Christian Ward, in which there were 4 cases of enteric fever. She was treated the whole of the month before the enteric fever developed by enemata, and as there was but one instrument in the ward during this time, it was used in common for this case and the enteric fever cases, which in like manner required the frequent use of enemata, and occasionally for two or three other patients.

At first sight, it looks as if the enema apparatus was the means of conveying the disease, but a careful consideration of the circumstances renders this theory very doubtful.

First, as to the patient herself. She was certainly predisposed to an attack of enteritis. Apart from the gastric irritation and tenderness, obstinate constipation had existed for many weeks previously, and constipation is, I believe, the proximate cause of many an attack of enteric fever. In vol. xi of 'St. Thomas's Hospital Reports' I have recorded a case of death from constipation which came under my notice in the London Fever Hospital. The patient, a young man, aged 17, was admitted moribund and without any indications of abdominal disease, the abdomen in fact being shrunken and flat. He died the following day. The small intestine was empty, the mucous membrane everywhere injected and covered over with a layer of purulent-looking mucus ; the surface beneath was red, vascular, bare, and in patches much inflamed. The whole of the large intestine was impacted with fæces, the cæcum with one large, stiff, greenish mass weighing about a

pound, and the contracted colon with tripartite masses of hard scybala forming, in fact, a cast of the contracted tube.

On raising the scybala the mucous surface was found to be injected, covered with a thick layer of yellow, opaque mucus, and at some parts, in the cæcum especially, the mucous membrane was much inflamed.

A very little disturbance here would have set up a general and violent enteritis.

To return to the case of the young woman. She left her bed at the end of a fortnight, and from that time to the end of the month probably disregarded the state of her bowels, for she was not allowed aperients, and disliked the use of enemata.

Other objections to the theory of convection are found in the fact that none of the other three patients who used the apparatus—two of them were children—were affected, and that the instrument was kept scrupulously clean.

As I wish hereafter to speak of the relationship of enteric and scarlet fevers, and as we are still considering the subject of contagion, I cannot refrain from narrating my own experience of scarlet fever in this aspect.

Scarlet fever is regarded on all hands as pre-eminently contagious, and I well remember the warmth with which one of our most amiable Presidents, Sir Thomas Watson, resented a suggestion, made I think by a correspondent of the 'Times,' to the contrary.

My experience excited my surprise, for I have been all my medical life, up to that time and since, endeavouring to obtain proof of the contagiousness of scarlet fever. As yet I have failed to find it, but have acquired some evidence to the contrary. Both in private practice and in the fever hospital I have seen whole families affected, one member falling ill after another, at intervals of a few days, a week, or even a fortnight, and have witnessed, as I supposed, the operation of an endemic cause. I have never known imported cases propagate the disease, and I have never witnessed its spread, under the most favourable circumstances, among the convalescents in the fever hospital.

Up to the year 1879 the only disease I had contracted was a slight attack of measles in childhood, and for the three years during which I was resident in the Stockport Infirmary and Fever Wards and the twelve years during which I was attached to the London Fever Hospital I did not experience any febrile attacks. During some seasons my scarlet fever wards at the London Fever Hospital were crowded with the severest forms of the disease, many having sanious discharges from the nose and ears, and others suffering from suppuration of the cervical glands and surrounding connective tissue. After visiting these wards I have from time to time spent an hour or two in the post-mortem examination of patients dead of the disease, and on two occasions I have accidentally inoculated myself with the warm blood of a patient who had died an hour before of scarlatina.[1] On one of these occasions my assistant, Dr. William Henderson, also wounded himself, and I had no sooner taken the scalpel from him than it slipped, glanced off my nail, scratched the back of my thumb, and finally punctured the fold of skin between the thumb and forefinger. We sucked our wounds, bound them up and proceeded with our task, which was only just begun. Neither of us took the least harm and our wounds healed by the first intention.

But let me say by way of parenthesis that we were not insusceptible—at least Dr. Henderson was not—for, a year or more after, in making a post-mortem examination of a case of peritonitis for me he pricked his finger, the puncture suppurated, lymphatic inflammation spread up the forearm, and a fortnight after the accident he was extremely ill with fever, which bore a strong resemblance to scarlatina and was followed by general desquamation.

As to myself, let me ask your attention to the sequel. Eight years after my connection with the London Fever Hospital ceased and nine years after my last inoculation,

[1] The post-mortems were made thus soon after the death on the fifth day of the fever in order to ascertain, as I supposed, that death was caused by the clotting of blood in the heart, indicated by the suddenly deranged action of the pulse.

I experienced a severe attack of scarlet fever at a time when I had not, and had not had any case under my care and knew of contact with none. On November 20th, 1879, having found the early morning very warm and muggy, I left home at noon without an overcoat and drove to the City in a hansom cab. There had been a fall of 15° or 20° in the thermometer since early morning, and in the evening the ground was covered with snow. I arrived at my office in the City thoroughly chilled. After my lecture at St. Thomas's I returned home, and then found that I had "taken cold." My throat was dry and congested, as it usually was when I took a severe catarrh. Besides this I felt no bad effects, but my throat became very sore and I did not leave the house the next three days, as I wished to avoid impairment of my voice, which threatened. I saw my patients at home as usual, and on the third evening I entertained—with some difficulty I must confess—a large company of my pupils at dinner. Next morning, on awaking, I was astonished and dismayed to find my body covered with a fully developed scarlatina rash, very bright in some places but dusky in others. My wife was by my side and a child 1½ years old in a cot beyond. I sent for my colleague, Dr. Ord, and asked him to find me a room in our hospital. But there had been a heavy fall of snow in the night, and as I was now very feverish he would not let me risk a removal. I remained in my own room and my family retired to a distant part of the house. I was very ill for the next few days, and before the end of a fortnight my skin was everywhere ragged with desquamation. I was convalescent at the end of a month from the time I took my chill. I used ordinary precautions and cleanliness, but did not think it necessary to take up the carpet of my bedroom, or to subject the latter to any process of disinfection, and at the end of another fortnight my wife and child resumed its use. At this time neither of my five children, ranging from 1½ to 10 years, nor three of the servants had had scarlatina. My wife was confined a

month later, and I attended her. My disease spread neither to my guests nor to any member of my family.

Previous experience of a similar kind several times repeated gave me the needed confidence on this trying occasion.

Convinced as I am that the chill was the sole cause of my attack, I cannot do otherwise than adduce this as an instance both of the spontaneous origin of scarlet fever and of its inability to spread.

If an illustration of the spontaneous origin of scarlet fever were wanted we may refer to that of common catarrh. Like this affection it springs up in households here and there, affecting some members simultaneously and others after intervals, all succumbing in the order of their proclivity, or as the effect of a more direct or longer exposure to the changes of temperature, pressure, moisture, and, it may be, other obscure interactions.

The scope of these lectures will not allow me to pursue the subject of contagion further, and I hope I have adduced evidence sufficient to entitle me to keep this misleading hypothesis in the background, while I carry my inquiries into the ætiology of enteric fever a little further.

Turning first to the histories of my own cases, I find that my clinical clerks have made the following entries:

Case 15.—A male, aged 12. Illness began in October with a bad cold and constipation. On the 7th day there were vomiting and general pains. He was admitted on the 21st day and discharged on the 62nd.

Case 18.—A male, aged 22, got wet in October and sat in his damp clothes. Next morning he had headache, chills and heat. He was admitted on the 5th and discharged on the 34th day.

Case 19.—A male, aged 12, got wet at a school treat in July, and has been ill since with cold shivers, headache and vomiting. He was admitted on the 21st and discharged on the 64th day.

Case 34.—A female, aged 21, got wet through in September, and this was followed by a cold, with low fever, shivering and diarrhœa. She was admitted on the 31st day and discharged on the 120th. Severe bronchitis attended the enteric symptoms, which accounts for her long sojourn in the hospital.

Case 40.—A male, aged 20. Both he and his master, a medical friend, got wet through while driving in July a long distance to see a patient. An attack of enteric fever immediately followed in both. He was admitted with diarrhœa and abdominal pain on the 6th day and discharged on the 25th.

Case 70.—A male, aged 23, was taken the day after a wetting in December with headache, shivering and pain in the limbs. He was admitted on the 8th and discharged on the 59th day.

Case 90.—A female, aged 31, caught cold in July and remained ill up to the time of her admission on the 31st day. She had both broncho-pneumonia and enteric fever and was discharged on the 66th day.

Case 104.—A male, aged 40, was wet through in September. Next day he went to work, the day following took to his bed with dizziness and diarrhœa. He was admitted on the 8th and was discharged on the 45th day.

Case 117.—A female, aged 22, got her feet wet and caught cold with pain in the neck; sore throat and fever followed. She was admitted on the 4th and discharged on the 16th day.

Case 131.—A male, aged 29, got wet through in October; this was followed by shivering, pain in the right side and cough. He was admitted on the 21st day and discharged on the 41st.

Case 184.—A male, aged 21, got wet in September and remained in his wet clothes; fever and pain in the back followed. He was admitted on the 5th and discharged on the 48th day.

Case 186.—A female, aged 21, caught cold in August, followed by headache, chills, prostration, pain in the legs and abdomen, diarrhœa and thirst. She was admitted on the 7th and discharged on the 49th day.

Case 203.—A female, aged 40, caught a severe cold in December, followed by cough, chills, flushings, retching, with much pain in the abdomen and back, and delirium. She was admitted on the 14th and discharged on the 74th day.

Case 223.—A male, aged 17, got wet through in October. A cold developed a few days afterwards, when he went to bed and got worse with pain in the abdomen. He was admitted on the 7th, and died of pneumonia and ulceration of the last 3½ ft. of the ileum on the 17th day.

Case 234.—A male, aged 22, caught cold in December, followed by sore throat. Diarrhœa began on the 18th day, but he followed his work until the 21st day. He was admitted with symptoms of impending or actual perforation on the 26th day and died of perforation of the ileum on the 31st day.

Considering the difficulties of getting a correct history of the onset of the disease from patients ill with enteric fever, the unbiased evidence contained in the cases just quoted is very valuable.

The cases themselves were severe ones, as is proved by their prolonged stay in the hospital, and the death of two of the patients.

Shall we, in face of such evidence, say that some other cause is needed to explain the origin and development of enteric fever? If we say that a wetting on a cold day,

in either summer or winter, and a prolonged chill to follow, is not of itself enough to kill a strong man we deny a daily experience. In killing him it causes a severe internal congestion; and this being so why and how should the mucous surface, the more vascular internal skin, escape? The intestines, from their arrangement and the length of their blood-vessels, are the part of the body most of all liable to congestion, and yet modern medicine can only recognise the existence of an enteritis under the form of a specific fever, with its incubation period, its days, its specific ulceration, and its specific poison.

Such metaphysical scholasticism is not science, but the very sublimation of presumption, for it takes things for granted which have never been proved, and which on the contrary can be easily and completely disproved. We hope and believe that medicine is advancing. There is no doubt it is in many directions, but this is certainly not one of them. We have from the nature of things many uncertainties, and we have created many vulnerable points; for this reason we should be the more careful, and avoid the unnecessary admission of ambiguity. Medicine as yet is not an exact science, and the attempt to foist such crudities as were suitable to the dark ages upon the attention and belief of the rising generation of medical men is to retard its progress.

In order to open up a free and unbiased view of enteric fever, I have thought it necessary to declare my convictions thus strongly. It is twenty-five years nearly since I first broached them in the first volume of 'Reynold's System of Medicine' in these words:

"There can be little doubt that the usual symptoms and post-mortem appearances of enteric fever may arise during the progress of several other acute diseases, as a consequence of a general inflammatory condition" (p. 625).

Such a statement of course implies that enteric fever does not possess any specific character, and isolated illustrations of its truth would, I know, frequently occur both in private and hospital practice; but the influence

of a scholastic training would, I felt convinced, prevent their recognition; and that nothing short of the experience of a military campaign would suffice to expose the true nature of enteric fever by demonstrating its natural associations, and proving that its development—that is to say, the ulceration of the intestinal glands and its attendant symptoms—is but a mere accident in the progress of those severe congestive strains of the internal organs which always happen to those who, imperfectly protected against diurnal variations of temperature, are exposed to the exigencies of warfare.

Such evidence is now available, bought as usual at a terrible price, and plain to all who wish to know the truth. It is contained in the history both of the Franco-Prussian War and in that of the American War of the Rebellion. For my present purpose I shall take the latter of these two publications. It is compiled from the reports of a great number of important observers, and collated and revised with the greatest care, industry and ability by Dr. Woodward and Surgeon-Major Smart.[1] I am deeply indebted to these gentlemen for so kindly and liberally supplying me with the ponderous volumes from which rich mine I shall draw many illustrations.

While the reader is employed in studying this treasury of medical experience he will not fail to observe that, with few exceptions, the labourers employed in its formation have been strongly influenced by the sophistry of the schools. At almost every page we see them writhing under a thraldom which they cannot escape.

Bound by artificial restrictions, they are at their wits ends to know how to classify their cases; whether, for example, this particular one shall go amongst the malarial fevers or the typho-malarial, or whether it does not properly belong to a "specific typhoid."

I seem to recognise Nature in the background saying

[1] 'Medical and Surgical History of the War of the Rebellion,' part ii, vol. i, and part iii, vol. i, by Dr. Joseph Woodward and Surgeon-Major Charles Smart. Qto. Washington, 1879–1888.

to herself: "How vain to think of impeding me with these flimsy shackles, which will fall off with the next right turn of the mind!"

As a matter of fact we are shackled by the proconceptions and prejudices derived from our teaching with which we weave a veil through which it is difficult to see Nature as she is. It is easy to learn, but next to impossible to unlearn, so indelible are first and early impressions. How careful, therefore, as expositors of Nature, we should be to avoid misleading hypotheses, and to rely upon facts alone.

SECOND LECTURE

In my former lecture I discussed the questions of contagion and of specific character as applied to enteric fever.

I advanced objections against the germ theory of disease; I challenged proof of the statements that enteric fever can be distinguished specifically from other common inflammatory affections, and denied that it possessed any contagious properties.

I propose in the present lecture to advance such further evidence of the truth of my argument as may be obtained by tracing the relationship between enteric fever and other diseases.

For reasons which will appear in the progress of the inquiry, I will first of all endeavour to trace out the connections between ague and enteric fever. The intimate relationship of these diseases has been forced upon the attention of every practical field officer from the earliest times, and a great difficulty has always arisen in classifying these and other related diseases. As an illustration of this I will quote a footnote to p. 119 of the third part of the 'Medical History of the War of the Rebellion':

S. K. Towle, Surgeon, Mass. Vols., referring to the complicated character of the diseases observed in the *Army General Hospital at Baton Rouge*, during the year 1863,[1] says: "Indeed the symptoms of many of the cases would indicate rather a combination of diseases than any one disease—fevers being inexplicably combined with diarrhœa or dysentery, and *vice versâ*, so that one would hardly know under which class to make the record. And again, with the different varieties of fevers the record

[1] 'Boston Med. and Surg. Journ.,' vol. lxx, 1864, pp. 49–56.

will depend upon the period of observation; an intermittent, with marked stages, will, if neglected, often in a few days become an equally well-marked remittent, or typho-malarial; or, a little further on, will prominently exhibit advanced typhoid symptoms; or perhaps a few weeks or months later die from chronic diarrhœa or dysentery."

Speaking of the causes of ague, Dr. Maclean[1] says: "I desire to express my entire dissent from the doctrine that specific agues are the result of suppressed cutaneous secretion under sudden impressions of cold; if it were so we should have agues constantly occurring in temperate climates during the summer months in places where no miasma exists, which is contrary to all experience."

In answer to this statement made in 1866 I must adduce the fact that ague still exists in London, which I think our author will concede is both temperate in climate and, in comparison with malarial districts, free from miasm.

Westminster and the Pimlico and Lambeth marshes have in times past been fertile nurseries of ague, and in the fifteenth and sixteenth centuries would in this respect have rivalled many a noted malarial locality; the S.W. and S.E. district will be slow to acknowledge the existence of miasm in their midst. But let me refer to the facts. During the eight years that I was Assistant Physician to St. Thomas's Hospital, from its opening in 1871 to 1879, forty-four cases of indigenous ague came under my care. The ages ranged from twelve to sixty-one, the average being about thirty. Half were females, and the commonest variety of the disease was tertian. All but three cases from Essex[2] and ten from Kent[3] were resident in the low-lying districts around the Hospital, extending from Westminster and Battersea to Southwark, Walworth,

[1] 'Reynold's System of Medicine,' vol. i, p. 57.

[2] One case each from Plaistow, Bilsington and Malden.

[3] One case each from Erith, Gravesend, Strood, Rochester, and Milton; two at Sheerness, two from Cliff and Colehouse Point, one from Plumstead Marshes.

and Brixton—the districts in fact which, with one or two exceptions, furnished my cases of enteric fever.

Of these London residents nine males contracted the disease in the course of their avocations in the aguish districts of Kent. In the remaining twenty-eight the disease was developed in London.

It is noteworthy that, if we except the accidental sojourn of the nine men in the aguish districts of Kent, the women suffered in greater number—a fact due no doubt to their continual abiding at home, whereas many of the men doubtless were resident there only a portion of their time.

In illustration of this London ague of the close of the nineteeth century I will briefly adduce the following:

(3) Alfred P—, aged 16, resident in Lambeth, applied on May 20th, 1874, having suffered from tertian ague for the previous three weeks. The attack commenced with shivering, lasting three-quarters of an hour, was followed by heat, and ended in copious sweating lasting about an hour. The bowels were regular, but there was anorexia, the complexion was sallow, there was some tenderness over the liver and spleen, and the latter was enlarged.

(4) Ann K—, aged 21, resident in Westminster, applied July 30th, 1875, suffering from tertian and quartan attacks of ague. A year before she was admitted into St. Thomas's Hospital with enteric fever; this was followed by erysipelas, and she was altogether seven months in the hospital. The ague appeared after convalescence, which was effected at home. The shivering fits were severe, lasting two or three hours; they were followed by high fever and ended in sweating.

In another case (John O—, aged 30, resident in Lambeth) hæmaturia occasionally appeared in the attack.

It is clear, then, that we still have ague in London, but whether it be due to miasm in the sense in which Lancisci and his followers use the word I will leave others

to speculate. I know nothing of an aërial poison emanating from an open marsh. The conception was one worthy of the eminent countryman of Dante, and it has proved to be so suitable to the credulity of the medical mind that for the best part of two centuries and up to the present time it has remained the unshaken pivot upon which our ideas of intermittent fever have turned.

Nothing doubtless has retarded the advance of medicine so much as the translation of our ignorance into a subtle phraseology. And so long as it does so, so long will it remain an inexact science. What is the cause of ague? Accepting the hypothesis of Lancisci the eighteenth and nineteenth centuries have told us over and over again, "miasm." What is "miasm"? We do not know.

Everybody but a medical man who is brought up to the manner of it would see the absurdity of this. In this particular instance we have been so long taught to look to the air that we can hardly bend our gaze to the ground, and yet if the word "miasm" had been applied to terrestrial instead of aërial impurity, we should long ago have appreciated the truth that it is impure drinking water and not a mere aërial exhalation which is the predisposing cause of malarial fevers.

The following picture of the conditions in which ague arose amongst the troops engaged in the War of the Rebellion is drawn by Surgeon-Major Smart.[1]

"While generally warmly clad, the soldier was often chilled at night, or after profuse perspiration or exhaustion from fatigue. He was exposed to rains, and had to remain in his wet clothes for days at a time sleeping on the wet ground without shelter. At other times the exhaustion was consequent on forced marches or excessive labour under an oppressive sun. The water supply was generally surface collections, often foul naturally, and usually tainted by the inflow of the surface washings and drainage from neighbouring camps. And lastly mental depression.

[1] *Op. cit.*, pt. iii, p. 158.

"Several of the reporters refer to impurity in the drinking water as occasioning a predisposition to malarial affections." Surgeon-Major Smart traced the origin of remittent fever prevalent at Fort Bridger, 7000 feet above the sea-level, on the northern slopes of the Uintah Mountains in Wyoming Territory to the use of the river water constituting the supply of the post. It contained a larger quantity of organic matter than is found in good river waters, and he found that the maximum and minimum of the prevalence of the fever corresponded in time with the maximum and minimum of the organic impurity in the water supply. The increased impurity was coincident with rains and the melting of snow upon the higher ranges; and the diminished impurity with the flow of a small volume of clear percolated water.

To turn back to my own cases, one of my patients stated that he and three of his fellow workmen contracted ague at Cliff and Colehouse Point, on the estuary of the Medway, by drinking "brackish well-water."

The severest case of intermittent fever associated with enteric symptoms that I have ever witnessed was that of a strong, healthy man about 35 years of age, a master builder resident in the Marylebone Road. I saw him in consultation with my friend Mr. Astley Wakefield, of Nottingham Place, W.

The following is briefly the history:

In August, 1887, Mr. R— occasionally visited his family, which was staying at Dovercourt on the Essex coast, from Friday till Monday.

On August 15th he bathed twice from the shore and returned to town next day.

On the 24th he bathed at night. He was a good swimmer, but the tide served badly, and he was conscious of coming across the flux from the sewer, and took in a mouthful of the water and swallowed it, much to his disgust.

On the 25th he had another swim, and on this occasion also the tide did not serve.

On the 26th he returned to town and was ill with

diarrhœa, which continued for the next nine days, and in a milder form afterwards, with chills, sickness, pain in the abdomen and great flatulence. He was, however, able to continue his work out of doors.

On September 8th he sent for Mr. Wakefield.

On the 12th he was better and superintended the opening of a drain.

On the 13th he took to his bed, and after some days distinct paroxysms of ague were experienced.

On October 3rd at 8 a.m. he had a prolonged shivering fit, and before the hot stage had fully come on a second one at 10 a.m. when I first saw him. He lay upon his back shivering violently, the teeth chattering and the whole bed shaking. The face, lips and skin were pale, the hands pallid and cold, the nails bluish. The respiration was hurried. Pulse 112, regular, of moderate power, but contracting during the attack. Tongue clean, moist at the edges, glazed down the centre. He vomited an abundant alkaline mucous fluid containing a little brown slime after every paroxysm. The diarrhœa still continued, and he had three copious liquid evacuations every day. The body and feet were warm, the abdomen natural and bore deep pressure everywhere, and no enlargement of the liver or spleen could be detected. There was great thirst after the vomiting. He dreaded the shivering attacks, and thought he should never get better, and complained of feeling very cold in the spine. At 1 p.m., and before the hot stage was fully developed, he had a third fit. In each of these attacks the shivering fit lasted forty minutes.

Large doses of quinine were prescribed next day.

October 4th at 5 a.m. another paroxysm, and at 8 p.m. another; these were less severe, the shivering fit lasting only twenty minutes, and followed by heat and terminating in sweating. Great heat and sweating continued through the night.

October 5th at 8 p.m. another paroxysm.

October 6th at 4 a.m. and at 10 p.m. severe paroxysms.

October 7th at 5 a.m. another. At 10 a.m. pulse 80, of

good volume and power. Bowels for the last three days have acted only once a day. The stools are watery and dark brown and bilious.

He continued to sweat profusely in the intervals between the attacks, and there was no return of them until October 11th, when he had two severe paroxysms, the shivering lasting thirty-five minutes—one at 5.15 a.m. and the second at 7.15 a.m. Two days before cinchonism was very fully established, and he continued to take a daily dose of 15 gr. and a chop with ℥iv wine. The bowels still continued loose, and the motions, about three a day, were copious, and of a rich yellowish brown. The sickness after the fits was much less.

The paroxysms soon afterwards declined, the enteric symptoms became prominent and when Dr. Murchison saw him two days later on, he declared it to be a case of enteric fever. The patient died very soon afterwards.

Turning to the clinical history of the two diseases, we shall not fail to notice a complete similarity in the early symptoms in a great many cases.

According to Dr. Maclean the premonitory symptoms of ague are usually nausea, anorexia, muscular pains in the back and lower limbs, with usually a slight feeling of chilliness soon passing into trifling heat, which may recur for several days before a regular paroxysm of shivering fever with headache and sweating sets in. Referring to my cases of enteric form, I find the onset thus described by my clerks and assistants. Case 10, "cold chills followed by intense heat." Case 13 "began with chiefly rigors." Case 17, "cold chills." Case 27, "evening chills, pains in arms and legs." Case 60, chills, vomiting. Case 39 began with shivering and sweating. Case 54 with rigors, perspiration, vomiting. Case 52, slight shivering fits at night followed by profuse perspiration. Case 65 began with shivering, headache, profuse perspiration. Case 208, chills followed by fever at night; and so on. In 37 out of my 232 cases, the same initiating symptoms are mentioned. Thus allied in origin and onset, the relationship hereafter

becomes closer and closer, until the intermitted affection is merged in the continued fever, a mild form of remittent forming the link.

But even through the course of an ordinary attack of enteric fever, we can still trace the intermittent character in the daily rise and fall of temperature. Indeed I have occasionally noticed this feature after the temperature has finally fallen to a normal and subnormal state.

The following is an example :

Case .—Florence B—, aged 10, experienced an ordinary attack of enteric fever, the highest temperatures occurring between the twenty-second and thirty-second days and ranging from 103·2° to 102°F., and then gradually declining. The enlargement of the spleen continued to the fortieth day. Convalescence began at that time.

Day.	Max.	Min.	Diff.	
39	99·2	96	3·2	On these three days the max. occurred regularly at 4 p.m. and the min. as regularly at 8 a.m.
40	99·4	95·6	3·8	
41	99·2	96	3·2	
42	98·6	96·4	2·2	

The conversion of the paroxysm into a continuous febrile vibration is capable of illustration in many ways. Thus, for example, a person who has taken an intoxicating dose of alcohol for the first time, displays—let me assume—hilarity ; but frequent repetition of the dose will so accustom him to its use that these fits of excitement will be scarcely observable, for they will now constitute a continuous state of quieter excitement. So it is with ague. If the fit occur but seldom, its features remain strongly marked, but by frequent repetition of the morbid action they are softened into those which constitute the remittent variety ; and these at last become but slightly defined, or scarcely recognisable, and the disease thus passes into the continued form. It would appear therefore that the distinction is merely one of degree and of natural progress.

In the ague fit we have a sudden and intense congestion

of the mucous membranes, and when the cold stage is severe and prolonged often resulting in intestinal hæmorrhage and hæmaturia. But this condition is not long maintained, and in the intermission is more or less completely relieved. But the congestion of enteric fever is a continuous, and, so to speak, a chronic one, and it is necessarily less intense, otherwise the patient would not survive from day to day and week to week.

Excepting then in the circumstances that in ague the functions of the skin are not continuously overpowered, of which the intermission is the proof, and that in enteric fever we have an enteric lesion consequent upon the continued congestion, it is quite impossible to recognise a distinction between malarial and enteric fevers. It will be instructive to inquire by what process intermittent fever is thus converted into the continued form. In order to elucidate this question we must consider very attentively the conditions which exist in the ague fit.

I think there can be little doubt that the shivering fit is due to the cutaneous impression of cold. The intense muscular vibration and rapid breathing which attend the cold stage would in the normal condition of things produce an increase both of heat and carbonic acid, the result, in fact, being identical with that following the arrest of function of the skin. It is difficult to explain the object of this. If any loss of internal temperature preceded the paroxysm we should see the advantage of the involuntary muscular movements, but we have no evidence of a loss of internal heat preceding the fit. This is a point which would repay careful observation. As the blood leaves the surface and the functions of the skin are depressed, a rapid series of general muscular vibrations and increased respiratory movements are excited, the internal organs become congested, the temperature of the interior, especially of the liver and spleen, rises, and the shrivelled, dusky skin indicates an arrest of its respiratory and sudoriparous function. As the temperature of the surface rises the sensation of cold gives way to one of heat, the shivering

ceases, the spleen becomes palpably swollen, and the congestion of the mucous membranes is intense. If indeed it should rise sufficiently high hæmorrhage may occur from any part of it, and even melanuria, petechiæ (purpura) and icterus may appear. After an interval the blood returns to the skin and becomes cooled by an abundant and prolonged exhalation of sweat, and the body, after a paroxysm of ordinary intensity, returns quickly to its normal state. In the example of ague which I have adduced, very copious vomiting of mucous fluid followed each attack of shivering. The intestinal mucous membrane was in like manner relieved by very copious bilious stools.

But under the influence of the more violent congestion the patient frequently succumbs, and evidence of the terrible internal congestion is everywhere visible, while the microscope reveals wreckages of the blood, blocking the minute vessels of the parenchymatous organs, especially of the spleen, the intestinal glands, and the kidneys.

But while a certain number—and these no doubt the strongest and healthiest—of those who have experienced an ordinary paroxysm of intermittent fever do return to the normal state, there are a larger number of others who, being generally, or in some one organ, specially weaker, only partially recover from this internal congestion; and this remnant of the primary paroxysm will prove the departure of a variety of morbid conditions. If the congestion has fallen heavily upon the intestines, diarrhœa or dysentery may result; if upon the lungs, bronchitis or pneumonia; if upon both lungs and bowels, as very often happens, both diarrhœa and pneumonia may supervene; thus directly converting the intermittent into a continued fever.

At p. 240 of the 'Medical History of the War of the Rebellion,' eleven cases of typhoid fever are given in which aguish paroxysms preceded the development of the continued fever. The following is an example:

"Case 97.—Private B—, aged 23, suffered with quo-

tidian chills during August, 1861, and on September 7th was admitted. Diagnosis—typhoid fever. The patient was weak, dull and stupid, pulse 104, skin hot and dry, tongue dry, brown, heavily coated, the bowels relaxed and painful. Six liquid stools were passed during the next twenty-four hours; the right iliac region was tender. On the 9th delirium, epistaxis, rose-coloured spots, and three thin dark stools were noted, and on the 10th subsultus and aggravation of the diarrhœa. A profuse eruption of rose-coloured spots and sudamina appeared on the 14th, the stools were passed involuntarily on the 16th, and afterwards the abdomen was tympanitic and tender. The diarrhœa (five to six stools daily) continued to the end, fresh spots appeared on the 19th and he died on the 20th."

I need only refer to what I have said of the "chills" which so frequently preceded my cases of enteric fever to prove that this case differs in no respect from those which are continually produced in the low-lying districts of this city.

Let us now look to the effects of intermittent fever as indicated by post-mortem examination.

In the autopsies of nine cases of death from intermittent fever recorded in the 'Medical History of the War of the Rebellion,' p. 131 *et seq*, it was observed that the fatal result was due to congestion of the internal organs, but not always of the same organs, no one organ being apparently more liable to injury than another.

In one case (53) both lungs were much congested throughout, but nothing abnormal could be detected in the stomach or intestines.

In another (54) the liver was greatly enlarged and congested, the spleen much enlarged, softened and infiltrated with pus in the upper part.

In the third (55) the brain was congested and there was serous effusion in the ventricles. The lower lobe of the left lung was newly hepatised; the liver and spleen were greatly enlarged.

In a fourth (56) the lungs posteriorly and small intestines were intensely congested, the jejunum black or dark purple, the ileum cherry-coloured above and darker coloured below, the kidneys large.

In a fifth (57) there were signs of pre-existing broncho-pneumonia and congestion of the ileum.

In a sixth case (58) the spleen was greatly enlarged and softened, the liver much enlarged, the kidneys fatty, other organs normal. The intestines are not mentioned.

In a seventh (59) both lungs were congested and adherent, the spleen dark and congested. The intestines contained a mixture of coagulated blood and mucus and the mucous membrane was deeply congested and almost black.

In an eighth (60) both lungs were in the third stage of pneumonia and the liver large, the spleen large and soft, and the pelvis of the kidneys contained pus.

Evidence of the early and continued congestion of the mucous membranes is not wanting in my cases of enteric fever. Epistaxis was of course frequent among the early symptoms, and in one case it is noted that two pints of blood were lost. Hæmaturia occurred in one case, hæmatemesis in two, hæmoptysis in one, and hæmorrhage from the bladder in two cases. In one of these, a woman, aged 49, this occurred on the 55th day, a large stringy clot being passed with difficulty. On the 60th day symptoms of gastritis appeared, preceded by a rigor, followed by a profuse hot sweat, the pulse rose to 152, the temperature to over 104° F. and she vomited much ropy mucus containing bile and dark blood. There was no remission of temperature and it reached 105° F. on the 63rd day, and then declined but rose again on the 68th day, when Broncho-pneumonia and pleuritis were developed. At this time the enlargement of the spleen had disappeared and there was no return of the tympanitis or diarrhœa. Quotidian variations of temperature, sometimes as much as 3°, continued to the 96th day. She was convalescent on the 148th day.

I am at the present time attending an old gentleman,

aged 82, who for the last eleven years has suffered from chronic cystitis, the sequel of the acute form which occurred during the course of an attack of enteric fever, and it was only last week that he was alarmed by a slight hæmorrhage from the bladder.

The occasional relapses which are often witnessed in enteric fever, and also the critical outburst of sweat, may be regarded as additional indications of the relationship which I am endeavouring to substantiate.

While the internal organs remain congested throughout an ordinary attack of enteric fever the functions of the skin are arrested. This single fact is sufficient to account for the pyrexia, the continuity and severity of which are proportionate to the extent to which the respiratory and sudoriparous functions of the skin are suspended. In the majority of cases the surface remains hot, dry and almost dusty from the presence of a fine desquamation but occasionally we shall notice a quotidian or tertian tendency to perspiration, or even actual sweating, to the great relief of the patient. But when these beneficial oscillations do not occur, the only relief to the fever is the outpouring of fluid or of blood from the intestinal canal both of which, if the hæmorrhage be capillary, are attended by a fall in the temperature and a general amelioration of the symptoms.

Thus recognising the more or less complete suspension of the cutaneous functions as the cause of the pyrexia in both intermittent and continued fever, we shall be at no loss to find cause for the resultant morbid changes. At first, probably under the influence of an exalted temperature, the functions of the spleen and liver are stimulated. We have evidence of this, in the case of the liver, in the profuse bilious vomiting, or diarrhœa, which so often attend the early days of both diseases; but when the temperature rises still higher—probably any temperature about 104° F.—instead of an increase of function there is a diminution or even arrest. Post-mortem examinations reveal the truth of this statement. In no case of enteric

fever dying during the first three or four weeks of the disease have I ever found the bile in a healthy condition; in all cases it is thin and watery. It is sometimes acid and sometimes the contents of the gall-bladder are even colourless. In three or four cases I have seen the inner surface of the gall-bladder, on opening it, as colourless as this sheet of paper, and only moistened by a little mucous fluid—there could have been no bile in such a gall-bladder for many days. This is very plain pathological speaking, and has a very deep signification. We know that there is no increase of pigment in the body in typhoid fever—indeed, the urine is paler than normal. In such a case as I have instanced there was for an unknown period before death, but for several days, certainly, an arrest in the conversion of hæmoglobin into biliary pigment, and inferentially the formation of red corpuscles was at an end. These are undoubted facts, but there may be another interpretation of them. If the whole of the lymphatic tissue were in the condition of that of the intestines and mesentery it might be expected that no colourless corpuscles were formed to be carried to the spleen. This is, of course, an extreme case. In an attack of ordinary severity we *have* evidence of the formation of bile, and therefore, no doubt, of blood too, for they are interdependent processes; but it is very evident that there is a great impairment of function both of the spleen and liver. Meanwhile the intestines and lungs, too, are laden with blood, and the most vascular parts of the former, the lymphatic tissue, shares in the congestion. The whole mucous membrane is swollen and softened by the actual exsudation of fluid, and irritated by the passage of imperfectly preserved fæcal matters over its surface. Under conditions so favourable for morbid action the delicate intestinal glandulæ become excoriated and ulcerated, if indeed they have not already become sloughy from the prolonged congestion to which they have been subjected.

Further evidence that the congestion is a common one

and independent of a specific infection of the intestinal glandulæ is to be found in the lungs. Indications of the participation of these organs in the general affection is observable in the great majority of cases, and from the faintest signs—a few scattered rhonchi and dry crepitations—of dryness of the mucous membrane to profuse bronchitis, or fatal pneumonia, we witness every intermediate condition. Following the French pathologists, I have elsewhere [1] used the term "pneumonenteritis" to denote the intimacy of this association.

Speaking of the frequency with which acute lung disease attended enteric fever amongst the troops engaged in the War of the Rebellion, Surgeon-Major Stuart [2] says: "With or without the continuance of diarrhœa, the cause of enteric fever was often prolonged by the development or aggravation of cough pain in the chest, hurried breathing, and the physical signs of the pneumonitic processes. Patients subject to bronchial cough from the early days of the attack were specially liable to this complication, the mucous expectoration became purulent and bloody, sometimes viscid and rust-colored. In favourable cases the duration of the sickness was much lengthened by these attacks, and if no serious intestinal or cerebral symptoms were present, the lung disease assumed a prominence which led in many instances to a diagnosis of pneumonia by medical officers who had not observed the case from its commencement."

Referring to a particular report he further says: "Chest symptoms are mentioned in 31 of the 51 seminary cases. Bronchial cough dry or with frothy expectoration was frequently an early symptom of the attack. In 12 cases the chest symptoms were severe, one died of pulmonary congestion, and in another an attack of pneumonia preceded the typhoid onset."

Further: "Bronchial cough was sometimes associated with hoarseness, indicating the participation of the

[1] 'St. Thomas's Hospital Reports.'

[2] 'Medical History of the War of the Rebellion,' part iii. p. 277.

laryngeal mucous membranes. Post-mortem observations showed in many instances the presence of ulceration of this membrane" (p. 297).

The experience of the War of the Rebellion agrees precisely with my own here in London both with regard to the association of pulmonary and laryngeal inflammation.

I find that in 47 of my 232 cases, or 20 per cent., pulmonary complications were severe, and in 21 of them cough is mentioned amongst the initial symptoms. Of these 47 cases, 24 were acute bronchitis, 12 broncho-pneumonia, 9 simple pneumonia, and 2 pneumonia with pleuritic effusion.

Of the fatal cases five at least died of the pulmonary complications.

Thus in Case 11, female, aged 29, died on the 30th day. For the first 20 days she had severe diarrhœa. The last 10 feet of the ileum showed the Peyerian and solitary glandulæ swollen, with here and there a healing ulcer, the process being comparatively old. The solitary glandulæ of the large intestine were all congested, with breaking-down centres. The mesenteric glands were enlarged and congested. There were old adhesions of and caseous deposit in the apices of the lungs and patches of acute broncho-pneumonia.

In Case 212, male, aged 35, who died on the 97th day, the last 9 inches of the ileum presented several clean-cut ulcers lying upon the bare circular fibres. The gall-bladder was empty and colourless, the left lung collapsed, œdematous and congested, the right almost wholly consolidated, so that it sank in water.

In Case 213 the enteric and pulmonary inflammation seem to have had an equal share in bringing about the fatal result, but there was no post-mortem examination to verify this view. The patient was a male, aged 27, and died on the 33rd day of the disease. He was admitted on the

27th, much flushed, with dyspnœa, respirations 48, abundant moist crepitations and dulness over the upper portions of both lungs. The pulse was markedly dicrotic; there was vomiting of bilious fluid and profuse diarrhœa, with a little blood on the 28th.

In Case 214, a female, aged 22, who died on the 7th day after admission and the 17th day of the disease, the fatal issue was due to general bronchitis with old adhesions, and pneumonia of the base of the left lung, which sank in water. There was characteristic swelling and ulceration of Peyer's patches in the last 7 feet of the ileum. The spleen was enlarged and soft.

Case 216, that of a female, aged 21, also died of pneumonia on the 4th day after admission and on the 25th of the disease. The respirations were 44 and shallow, the left base of lungs was dull, there was delirium and moderate diarrhœa.

Case 217 also died mainly of pneumonia 13 days after her admission and on the 27th day of the disease. She was 26 years of age. She had had diarrhœa, but during the last 15 days of her life the bowels were generally confined and it was necessary to give an enema. On the 17th day she had two formed stools. The ulceration commenced 8 feet above the ileocæcal valve, but the ulcers were small, superficial and scattered to within a foot of the valve, when they became an inch in diameter, clean cut, and with very steep edges. There were a few more recent ones with yellow sloughs in the cæcum. The liver was large, with several gummata on the convex surface; the body presented syphilitic scars, and there was some exfoliation of one of the parietal bones. There were a few old adhesions of both pleuræ; the lower lobe of the left lung was in a state of grey hepatisation and sank in water.

Case 200.—Male, aged 15, is another instance of death from pneumonia on the 66th day of the pneumonenteritis

and 6 days after his admission into hospital. A few ulcers were scattered through the last 8 feet of the ileum. Near the valve the ulceration was rather extensive, and some Peyerian glands were occupied by yellow sloughs. The ascending colon, 8 inches from the valve, displayed a few ulcerations of the swollen solitary glands. The spleen was large and soft. Almost the whole of the right lung was in a state of grey hepatisation, exsuding pus when squeezed, there was severe congestion of the left lung and the middle lobe was also in the state of grey hepatisation.

Case 223, male, aged 17, is yet another instance. In this case the pneumonia was scattered, evidently the result of several emboli. He died the 26th day of the disease, having been in the hospital 19 days. The first intestinal ulcer was $3\frac{1}{2}$ feet above the valve; below this they were numerous, and all had adherent yellow sloughs. There were old adhesions at the summits of lungs; the posterior halves of the middle and lower lobes of the right lung were in a state of red hepatisation, and there were several patches of pneumonia in the lower lobe of the left lung.

Case 230.—Male, aged 18, died of exhaustion on the 45th day of his illness. He had had a discharge from the ear for a month, but dates his inability to follow his work to 5 days before admission. The diarrhœa was very moderate: he had only 16 stools during the 10 days he was in hospital.

The mucous membrane of the stomach was congested and the cardiac end was besprinkled with fine hæmorrhages. In the last foot of the ileum there were several very large irregular, clean-cut ulcers lying upon the bare transverse muscle; higher up some of the agminated glands had adherent sloughs. The spleen was very large and soft. The right lung was bound at the apex by old adhesions, and was partly consolidated by pneumonia in the third stage.

No further evidence will, I think, be needed to show that enteric inflammation is in the great majority of cases associated with a more or less severe inflammatory condition of the lungs; that in the severity of the symptoms each may take precedence of the other; and that in a great many of the fatal cases of enteric fever death is due to pneumonia.

Corroborative evidence is found in many cases of pneumonia in which we may find the intestinal glandulæ more or less deeply involved in inflammatory action—cases in which, from the absence of symptoms, intestinal complications were never suspected.

After the consideration which we have given to the general relationship between intermittent and enteric fevers we shall be prepared to appreciate that closer relationship which is implied in the term *typho-malarial* used by Dr. Woodward, and generally adopted by the medical officers of the American War of the Rebellion.

Dr. Woodward claimed that the prompt acceptance of this term showed how widely the opinions he had formed were shared by the medical officers of the army. As authority for its adoption he says: "Moreover, while a certain amount of uncomplicated enteric and remittent fevers certainly did occur, especially at the commencement of the war, the vast majority of the camp fevers of the army were of a mixed character, exhibiting undoubted enteric phenomena, variously combined with the periodicity and other peculiarities of malarial disease" (p. 75). Surgeon James King, speaking of the sanitary condition of the troops under his command, says that it was impossible to classify either as pure malarial or as pure typhoid all the cases of fever that occurred. He regarded them as mixed affections, combining in varying degrees the characteristics of both the diseases named. In some the diagnostic symptoms of malarial fever predominated, in others those of the typhoid affection, while in others again there was such a blending of symptoms that it was difficult to say which was the prominent disease (p.

363). The reports of other observers contain similar statements.

Reviewing the records of the post-mortem examination of the fatal cases of the so-called *typho-malarial fever*, Surgeon-Major Smart makes the following comments:

"From the frequency with which ulceration of Peyer's patches was found in the post-mortem examinations conducted at the general hospitals, the staff officers of these institutions very generally concluded that the prevailing fevers of the Army were essentially typhoid. The cases which occasionally presented an unaltered intestinal mucous membrane, or one changed only by an apparently unspecific congestion, were accepted as showing that death had resulted from the malarial influences to which the troops were almost constantly exposed. But these cases seldom lived to reach the general hospitals, or, if they did so, died subsequently, not from the primary fever, but from secondary pneumonic or intestinal complications, the latter of which offered to view extensive ulcerations of the intestines simulating the appearance of typhoid fever. Typho-malarial fever, therefore, to the medical officers of these hospitals generally, implied an enteric lesion. Positive results were obtained at the necropsies and specimens were forwarded to the Army Medical Museum in such numbers as seemed to the pathological anatomist to leave no doubt of the character of the prevailing fever" p. (374).

This evidence of the identity of enteric and typho-malarial fevers is conclusive, and requires no comment.

Remittent fever is the necessary link between intermittent and continued fevers.

It may be simply regarded as quotidian ague, in which the pyrexia declines so slowly that a normal temperature is not reached before the accession of another exacerbation.

The declensions or remissions of the fever are associated with and undoubtedly dependent upon a partial and insufficient restoration of the sudoriparous function but not amounting to a sensible perspiration; and they are

often so imperfectly marked that a slight decline of the thermometer is the only indication of them—the fever has, in fact, become continuous, and there is nothing in the general condition to distinguish it from enteric fever, which, as we are aware, presents in almost every case a daily remission. In many cases the remission is attended by a slight sensible perspiration, in a few an apyrexial interval—a distinct intermission—occurs, with a more or less copious outbreak of sweat. In this condition the temperature may never rise above 99°F. for two or three days and convalescence appears to have begun; but at the end of this time the temperature increases, the skin again becomes dry, and the patient is said to have a relapse.

As soon as remittent fever assumes the continuous character, there is nothing to distinguish it from enteric fever. In their relapses their features are identical, and in their morbid anatomy the two fevers are indistinguishable. The post-mortem examination of cases which were early classed as remittent proves that they died with the characteristic lesions of enteric fever.

I have now traced the relationship of enteric fever to the malarial fevers, and adduced evidence sufficient I hope to convince my audience that enteric fever is but the accidental outcome of the severe internal congestion which is the main feature of the malarial fevers—or in other words, that it is one of the most prominent results (pneumonia being the other) of that congestion which, when it is unrelieved, passes from the intermittent into the continued form.

It remains for me to show in a still larger class of cases, viz. those of simple diarrhœa and dysentery and in which the internal congestion is relieved by a copious exudation from the intestinal mucous membrane, how the lesions characteristic of enteric fever may be developed.

The history of a case of simple or pyrexial diarrhœa will repay a minute's attention, and for the illustration I will use a personal experience. Attentive to my health

and not at all liable to derangement of the stomach or bowels, I was suddenly called to the closet an hour before the usual time one morning in January last, and quite unexpectedly passed a very copious motion, dark brown, partly solid and partly liquid, with much gas, in which I recognised the odour of a post-mortem examination which I had inspected for about an hour and a half three days before. After five hours there was another very free action, yellow and bilious. The next day there was very active bilious diarrhœa, eight stools being passed. On the 4th day and continuing till the 8th day there were five or six liquid stools a day, of the colour and consistence of pea soup, but becoming almost colourless towards the end of the time. I was rather harder worked than usual during this time, and as I had taken only water gruel for the last five days I was begining to feel weak. The bile, too, had almost completely disappeared from the stools, and I thought of the possibility of drifting into enteric fever. Next day, however, the bile reappeared, the motions began to have consistency, and as the improvement was not interrupted I was well again in the course of two or three days.

During the attack the pulse and temperature were normal, the tongue only a little furred at the root, and the complexion was clear. There were no chilly feelings, and I seemed to tolerate the cold weather which prevailed at that time better than usual. My only discomfort was from abdominal distension, and occasional griping pain from the movement of air and fluid from one part of the bowels to another, and towards the end there was some scalding and tenesmus. My appetite was fair, but my taste was wrong, every flavour being disturbed by a prevailing sweetness.

On looking for the cause of this attack I could find only three possible factors: A little seakale fresh from the garden eaten sixty hours before, a fresh egg eaten forty-eight hours before, and the post-mortem odour inspired three days before.

First as to the egg. This has never been a favourite article of diet with me, but up to the age of twenty-three I occasionally ate one—never more—and enjoyed it, and it always, as far as I know, agreed with me. About this age and without any known cause eggs suddenly began to disagree with me, and for the next ten or twelve years invariably acted like an irritant poison, producing vomiting and purging. Since this time I have tolerated them, sometimes being a little dyspeptic after my experiment—for remembering my past experience I am always doubtful of the result; and as a rule I avoid articles of diet containing eggs on account of the formation of sulphuretted intestinal gas. Indeed, it has seemed to me that the sulphur with which the egg albumen is combined has something to do with my inability to digest it, for the effect which I have just mentioned always follows the ingestion of the culinary Brassicaceæ, especially seakale, which contains the largest proportion of sulphur.

I have found that this idiosyncrasy with regard to eggs exists but very rarely in others. I have met with but four or five instances.

With regard to the post-mortem odour, this has a distinct bearing upon the influence of sewer gas, and will, I think, repay a moment's consideration. It is, I believe, a common experience that the post-mortem gas taken in by the lungs is eliminated absolutely unchanged, as far as concerns the odour, by the intestinal mucous membrane. It is a very notable fact. Straining, as the tainted air does, through the pulmonary capillaries, it was reasonable to expect that the oxyhæmoglobin would oxidize the sulphuretted hydrogen, and that there would be a proportionate increase of sulphates in the urine. We cannot for a moment assume that this putrid gas circulates in solution in the blood; the alternative supposition is that it in some form or other displaces an equivalent proportion of the oxygen of the hæmoglobin; and that when the blood arrives in the liver, or upon the intestinal surface, it is liberated unchanged. The direct effect of putrid

odours—such as escape, for example, during the opening of a drain or cesspool—in producing immediate illness passing into enteric fever can only be accounted for by this profound and direct impression upon the blood.

In my case it appears that three sulphur-containing matters—seakale, egg, and sulphuretted hydrogen—neither of which is well tolerated in my somatic laboratory, found their way into it and produced the results which I have described. Two of these articles, the seakale and the gas, I could have tolerated if I had taken them alone, or possibly together, but the combination of the three was too much for me.

Upon further consideration I think it must be in the liver where the difficulty induced by these agents arose. The increased flow of bile at the outset of the diarrhœa might be accounted for by the emptying of the gall-bladder by reflex excitation; but the subsequent partial suppression of bile—which in my case and all cases of simple diarrhœa can hardly be referred to spasmodic closure of the bile-duct—must be attributed to an impression upon the hepatic secreting cells.

What the nature of this impression is it is difficult to say, but the effect appears to be in the first instance stimulant and afterwards depressant.

A word in conclusion as to the dejecta. Between the fourth and eighth day it was impossible to distinguish between them and those of a typical case of enteric fever. There was the same absence of bile and the same pea-soupy character. The irritation caused by the passage of these imperfectly preserved stools is such as, if sufficiently prolonged, might be expected to set up inflammation in the intestinal glandulæ.

THIRD LECTURE

At the close of my last lecture I was endeavouring to ascertain the influence of putrid emanations upon the blood.

The question is an important one in reference to enteric fever, in the causation of which sewer-gas plays so decided a part. In ordinary cases the intoxication is a slow one, increasing, under prevalence of the cause, from day to day until a point is reached when the health becomes notably impaired. But in the case of a person who, in superintending the opening of a blocked drain or cesspool, is overcome by the stench, goes home, sickens, and dies, we witness the effect of a rapid and acute intoxication: "the life of all his blood is touched corruptibly," and we can conceive no other means by which this has been thus suddenly brought about but by the displacement of the oxygen of the hæmoglobin. We have no evidence that these putrid odours float free in the blood, and it is therefore highly probable that they are locked up in the hæmoglobin during their transit; and possibly do no more harm than what results from a depreciation of vitality proportionate to the displacement of the oxygen. In the case of post-mortem odours we have evidence of a protective influence within, in the liberation of the gas unchanged, this act probably taking place in the liver, but in the case of the more profound intoxications to which I have referred, it would appear that the displacement of the putrid gas does not occur, or that it is delayed and imperfect, and perhaps that in the process of liberation it aggravates the mischief which its displacement of the oxygen had previously engendered.

As I have already touched upon the subject of diet it

will be appropriate to say a few words about milk, which is often credited, and I believe rightly so, with the production of enteric fever. There is no fluid more liable to putrefactive changes, and when they have commenced, milk is a dangerous food.

But even when fresh it may be productive of mischief, owing to some derangement in the health of the cow. With many persons milk is not easily digested, and I have met with one person to whom it is a positive irritant. He is a remarkably hale old man, a farm bailiff. He consulted me for renal gravel and I recommended him a milk diet. "I never could in all my life," he said, "take milk; it always makes me sick and purges me."

Certainly none but savages should take raw milk. Raw flesh is better, for this does undergo disintegration and alteration by the gastric juice; but milk, which is already digested and prepared for absorption, passes by osmotic action, unchanged, through the mucous membrane; and for this reason it is, if uncooked, liable at any time to become a danger.

Our modern physiologists, indeed, who solve everything by experiment, but take little heed of the natural processes, teach us the contrary. They say that when milk enters the stomach the casein is precipitated, attacked by the gastric juice, and converted into "peptone" before it can be absorbed.

This is monstrous! Our old women know better, and what troubles arise when casein does become clotted in the infant's stomach. Milk in any quantity should be taken upon an empty stomach, for if solid proteid be present, the simple provision of Nature is frustrated, and it is only by an expenditure of nerve force that the milk is again rendered fit for absorption.

The illustration which I ventured to offer, of a case of simple apyrexial diarrhœa from the use of unsuitable food and putrid odour absorbed, has led to this digression from the main subject under consideration, viz. the relationship between enteric fever and simple diarrhœa and dysentery.

In pursuing this subject, I will ask your attention to the records of these disorders as given in the 'History of the War of the Rebellion.'

Looking first to the conditions under which diarrhœa arose we find the following: "Diarrhœa was noted after exposure to cold and inclement weather, particularly after marches during which the troops were insufficiently sheltered at night. Under such circumstances diarrhœa and dysentery occurred along with bronchitis and pneumonia, *e. g.* during the siege of Fort Donelson, Feb., 1862, the besiegers were exposed without shelter and even without fires at night to a light fall of snow, degenerating into sleet; as a consequence diarrhœa, dysentery and pneumonia of a typhoid type became fearfully prevalent."

Surgeon George A. Otis, commenting on the prevalence of diarrhœa in his regiment, then just assembled in camp at Springfield, Mass., expresses the opinion that those of the men who were unprovided with flannel under-garments were most liable to the disease.

In Company F Westfield, 100 strong, scarcely a man escaped. Surgeon I. H. Thompson, in charge of the 12th Marine Volunteers, says: "On the second day after our debarkation twenty-four privates and officers were attacked with diarrhœa and dysentery, and so rapidly the epidemic diffused itself that nearly every man in the command was affected with it during the following three weeks." "Regiments encamped in tents in healthy localities appear to have suffered, as well as those in which the men were huddled together in ill-ventilated temporary quarters in cities and towns, or crowded into wooden barracks left filthy by the former occupants" (p. 286).

The mortality was highest amongst the coloured troops, who were chiefly drawn from escaped slaves and had suffered much from exposure and privation (p. 8).

From such evidence as the foregoing we are again brought face to face with the fact that acute diarrhœa and certain associated disorders are the direct consequence of chills, often aided by exhaustion. A hot, perspiring

skin has been suddenly chilled, and its function thereby paralysed. A vast field of blood has been driven inwards, and the congested mucous membrane relieves itself by a simple acute diarrhœa. If the functions of the skin be restored, the minimum amount of harm will be done; if not the diarrhœa remains and becomes chronic; the excessive action leads to irritation, irritation to inflammation, inflammation to ulceration. The parenchymatous organs, notably the liver and the lungs, share in the struggle from first to last and are always more or less involved. Reduced to its simplest terms, the skin has been paralysed by a chill, and a morbid action has been vicariously established. The process is purely a physiological one. In reference to this, and to what I have stated at the outset as to the effect of a given variation of the external conditions upon similar constitutions, Dr. Woodward makes the following very pertinent observation on the "*occurrences of similar cases in groups*": "A noteworthy fact observed during the Civil War was the tendency of the cases of acute diarrhœa occurring in any particular command, at a given time, to present a number of phenomena in common, resembling each other both in the grade of the attacks, the constitutional condition of the patients, and the concomitant complications. Nor is this circumstance surprising, since large bodies of men were exposed simultaneously to similar morbific influences. Various grades of the disorder thus became epidemic, from simple looseness without pain to the severest inflammatory forms with divers coexisting constitutional disturbances" (vol. i, pt. ii, p. 285).

"The character of the diarrhœa prevailing at a given time in a body of troops was frequently modified by the simultaneous prevalence of certain other affections. A certain amount of dysentery occurred with every outbreak of acute diarrhœa, and the ratio of the cases of acute dysentery increased and diminished, as a rule, with the ratio of the cases of acute diarrhœa, though not always exactly in the same proportion. A portion of these cases of acute dysentery occurred *de novo* in subjects who had

previously enjoyed good health; but very often the dysenteric attacks supervened upon acute diarrhœa which had resisted treatment, or selected as victims those who were already suffering from a chronic flux."

"The simultaneous prevalence of diarrhœa with *intermittent and remittent fevers* is indicated in a number of the reports, and the monthly ratios of these fevers show a considerable similarity between their general distribution and that of diarrhœa, both as to season and region. It was also extremely common for intermittent or remittent fever to co-exist with diarrhœa in the same individual the fever sometimes preceding and sometimes following the initiation of the bowel affection" (p. 287). In other reports the co-existence of diarrhœa and *continued fever* was noted; and patients were often supposed at first to be ill with simple diarrhœa who ultimately proved to be in fact suffering from continued fever.

Reviewing the progress and termination of the cases of acute diarrhœa, Dr. Woodward proceeds to say: "The majority of cases terminated in recovery in a few days. Painless diarrhœa was often neglected for weeks until pain and fever set in. In some instances the diarrhœa passed into dysentery. Cases which set in with fever, or in which febrile symptoms appeared after a few days, assumed the quotidian or tertian type, presenting a train of symptoms not unlike those of malarial remittent fever. In other cases the fever was of a continued type, and this, taken in connection with the tympanites and tenderness in the right iliac region, produced in some instances a misleading resemblance to ordinary typhoid fever. In all these cases the fever was usually of an adynamic character, and the rapidity with which the patients became emaciated was a noteworthy circumstance. In the fatal cases the abdomen became greatly distended, the stools more frequent, and often very offensive and passed involuntarily, and the patient sank. Sometimes delirium set in and the patient died comatose. But more frequently the mind remained clear to the last. In other cases some intrathoracic inflamma-

tion, especially a low form of pneumonia, was developed in a few days before death and was the immediate cause of the fatal issue. In others marked symptoms of local or even of general peritonitis were recognised before death" (p. 289).

"In a considerable number of cases, after the subsidence of the fever, the diarrhœa continued with more or less severity, either continuously or at intervals, and finally assumed the characters of the chronic form of flux" (p. 290).

In the above summary of the progress and termination of acute diarrhœa Dr. Woodward shows the influence of scholastic training. He is speaking of diarrhœa, which he regards, from beginning to end, as a disease *sui generis*, and to be distinguished as such from all around it. And when towards the close of the disease the symptoms become indistinguishable from those of enteric fever, he says that "they have a misleading resemblance to ordinary typhoid fever."

But let us turn to the evidence furnished by the autopsies of acute diarrhœa. Owing to the fact that nearly one half of the deaths from this disease occurred on the field, the number of autopsies of cases dying in the early stage of the disease was comparatively small, while that of cases in which it was protracted was much larger, for in these the patient generally found his way into the hospital. "In some of the rapidly fatal cases of acute diarrhœa there was a reddish discoloration of the mucous membrane in patches varying from a few inches to several feet. These patches were more common in the ileum than in the jejunum, and were still more frequent in the colon, where they particularly affected the cæcum and sigmoid flexure. The patches varied from pale pink to livid purple, with occasional hæmorrhage into the mucosa or submucosa. In the majority of cases the solitary follicles in the reddened patches were more or less enlarged. In 13 cases the solitary glands of the small intestine alone were enlarged; in 3 cases Peyer's patches and the solitary

glands of both small and large intestines were enlarged; in 2 cases the Peyerian glands were alone affected; and in 4 others the Peyerian and solitary glands of the small intestine alone were enlarged. In the more chronic cases ulceration was commonly found."

"The rapidity with which ulceration was developed varied with the intensity of the disease, and the lesions differed in no essential degree from those observed in mild cases of dysentery: moreover the inflammation of the mucous membrane of both large and small intestines between the thickened patches of Peyer, which is of constant occurrence in enteric fever, differed anatomically in nothing from the inflammation observed in acute diarrhœa" (pp. 292–3).

The distinction between diarrhœa and dysentery is so purely artificial that in the living subject Dr. Woodward specifies only one symptom by which the latter can be distinguished, viz. tenesmus—the result merely of the implication of the rectum in the general enteritis. The post-mortem appearances afford no other distinction, and a review of the post-mortem records of the 800 fatal cases of acute and chronic diarrhœa and dysentery completely substantiates this conclusion.

In 239 of these cases I find such grave and extensive ulceration of the intestines as occurs in enteric fever. In 65 of these the small and large intestines were about equally affected. In 47 the small intestine was more gravely affected than the large; and in the remaining 127 cases the large intestine was the part most severely affected. Let me adduce one or two examples:

Case 164: *Diarrhœa.*—Private F— died three days after admission. Lower part of ileum inflamed, the last 2 feet intensely; solitary and agminated glands enlarged and inflamed, the enlargement increasing towards the valve. In the lower 2 feet the solitary glands were of the size of peppercorns and some had a central ulcer; the lower agminated glands were also exceedingly

enlarged, and the lowest superficially ulcerated. The large intestine was of a dark slate colour, with streaks and patches of inflammation throughout.

Case 174: *Chronic diarrhœa.*—A man, aged 35, died in the eighth week of his residence in hospital. The emaciation was extreme, the ileum inflamed, more especially at its lower part, the lower agminated and solitary glands intensely reddened, and the lowest four of the former ulcerated through at their centres to the muscular coat. The middle agminated glands contained black pigment; the latter were healthy. The colon was much contracted, its mucous membrane considerably inflamed, especially within the cæcum.

Case 237: *Colic.*—Captain M—, aged 45, had suffered from diarrhœa and colicky pains for some time, and died suddenly of perforation after a hearty supper. The peritoneal cavity contained three pints of turbid serum, and showed signs of general recent peritonitis. The solitary glands were ulcerated through the entire extent of the ileum, and two of the ulcers had perforated the peritoneum. There was also ulceration in the large intestine.

Case 240: *Chronic diarrhœa.*—Private A—, aged 18, died the twenty-fifth day after admission much emaciated. The gall-bladder was distended with watery bile, the spleen congested. In the ileum Peyer's patches were extensively diseased and many of them in an advanced state of ulceration; the solitary glands were also ulcerated. The mucous membrane of the transverse and descending colon was much inflamed and ulcerated at numerous points.

Case 286: *Chronic diarrhœa.*—A man, aged 20, died in the fourth week greatly emaciated. The tongue had been dry and the dejections frequent and bloody, with pain and tenderness along the track of the colon. The

lower part of the ileum was very much injected, and there were twelve old ulcers within a foot of the valve. The colon was much ulcerated, especially in the sigmoid flexure, the ulcers being half an inch or more across and lay upon the muscular coat. The spleen weighed 9 ounces.

Case 750: *Chronic dysentery*; typhoid fever?—Private R— died five days after admission of peritonitis. The intestines were very dark and glued together by recent lymph. The spleen weighed 8 ounces. The mesenteric gland a good deal enlarged. The lower portion of the small intestine was highly inflamed and ulcerated; the cæcum covered with extremely large ulcers, one of which formed a large perforation 1½ inches from the orifice of the appendix.

Case 838: *Typhoid dysentery.*—Private B— died the fourth day after his admission from the field. The mucous membrane of the intestines was thickened and softened, and there were numerous ulcers, especially in the small intestines.

It is to be observed that these examples of the morbid appearances observed in diarrhœa and dysentery above quoted are each noted by a different observer. The patients all appear to have been treated in the field for diarrhœa or dysentery, and some of them were in the hospital only a few days. Their doctors no doubt were content to accept the diagnosis with which they were sent into the hospital, and finally classed them under diarrhœa and dysentery. But the term "*typhoid dysentery*" and the query as to the existence of enteric fever in the case of "*chronic dysentery*" shows the hesitation with which the diagnosis was sometimes made. If these cases had been leisurely watched by medical men who were not engaged in the field, nor cognisant of the great variety of intestinal diseases prevalent there, they would no doubt have regarded every one of them as cases of enteric fever, and perhaps have regarded them as both

specific and contagious. The supposition that a patient who is in the third week of enteric fever must necessarily be confined to bed, or even the house, is misleading. It is not uncommon for one who is undergoing severe ulceration of the ileum to be actively engaged in his usual occupation to within a few days of his death. My last fatal case was an instance of this, and the maidservant whose case is narrated further on is another example. It is therefore probable that many suffering from diarrhœa on the field do not present themselves until perforation is imminent.

From this brief review of the origin, progress and termination of acute diarrhœa, I am forced to the conclusion that the origin, progress and termination of enteric fever is coincident and identical with, and therefore indistinguishable from it ; and that dysentery is but a slight modification or variation, sometimes one, sometimes the other, of the more or less general enteritis which is described as acute chronic diarrhœa and enteric fever.

I pass now to a brief consideration of the connection between scarlatina and enteric fever.

In an article on the " Pathology of Scarlet Fever,' published in vol. lv of the ' Medico-Chirurgical Transactions,' I have fully traced the relationship which exists between scarlet and enteric fevers, and have shown that the morbid anatomy of scarlatina, as far as the abdominal organs are concerned, is that of the early stage of enteric fever, and, as might be expected from such a close relationship, that enteric fever is often the direct sequel of scarlet fever. I regarded, and still regard, scarlatina and enteric fever as essentially lymphatic fevers, the former affecting the upper portion of the lymphatics of the alimentary canal and the skin, the latter the lower portion of this system and the skin in a much less degree, and I went so far as to call enteric fever "*abdominal scarlatina.*"

Occasionally, either at the onset of the disease or at some period of its course, the whole of the lymphatics of the alimentary canal and the skin are simultaneously

involved, and in such a case we have a confluence or "intercurrence" of these two diseases. A little consideration will show that if in a given case the whole of the lymphatics were simultaneously involved, evidence of this would be early declared in the condition of the fauces and skin, while the implication of the intestinal glandulæ would not be apparent until a variable, and often a very considerable, time afterwards.

An illustration of this fact will be furnished by the following narrative, in which evidence is at the same time furnished of the common origin of scarlet and enteric fevers:

My late colleague, Dr. Robert Barnes, requested me to take charge of a young married lady residing in Gloucester Place, Portman Square, who he feared was developing scarlet fever. Next day the symptoms allowed of a positive diagnosis, and the attack proved to be a severe one. Upon inquiry the following facts were ascertained: The family had been in residence in the house about a year, and as the lady had experienced an attack of enteric fever a few years before, and remained in rather delicate health, every precaution was taken and no expense saved to put this, their new house, in perfect sanitary order. The drains were renewed and the basement concreted, and I found it dry, airy, and apparently faultless; but on passing the head of a passage between the front and back parts of the house I was aware of a close smell, and on looking round saw in the recess the huge stone cistern in which the drinking-water was stored. Passing down by its side near one of its angles was the soil pipe, and about a foot from the under surface of the cistern its large waste pipe, as I discovered, joined the soil pipe at an acute angle. On lifting the lid of the cistern sewer gas was plainly perceptible. The open mouth of the waste pipe was nearly two inches in diameter. Such, eighteen years ago, was the perfect arrangement for saturating the drinking-water with sewer-gas and keeping the house supplied with it!

This was the only insanitary condition discernible, and

no one will deny its efficiency. But to go back to the victims. For a week or nine days before the mistress of the house was taken ill, all the five servants—there were no children—were taken one after another with sore throat, and the day before I paid my first visit, Dr. Barnes had sent the cook with well-developed scarlatina to the London Fever Hospital, where she recovered.

On about the tenth day of the lady's illness, the husband, who spent less time at home than the rest of the household, developed scarlatina and had a mild attack. About four days afterwards the lady requested me to examine the parlourmaid, who seemed unwell.

As this young woman had answered my ring at the door and taken me up to her mistress's room, I had seen her daily for the previous fortnight, but as she seemed active my attention was not called to her. On examination, however, I found that she had had a sore throat in common with the rest about three weeks before. She was a strong, muscular woman about 25 years of age, and said she had been feeling very weak with complete loss of appetite and nausea for some time and that she was now so weak she could scarcely go upstairs. She was ashy pale, had a temperature over 103° F. and some abdominal tenderness, but no diarrhœa. I diagnosed enteric fever and sent her into St. Thomas's Hospital that same day. She grew rapidly worse and died in the course of three or four days. The last 6 feet of the ileum was intensely inflamed, the whole agminate, and many of the solitary glandulæ being greatly swollen and in a sloughy condition. The sloughs near the valve were beginning to separate. The mesenteric glands and the spleen were much enlarged. The tonsils and lymphatic glandulæ at the root of the tongue and neighbouring part of the fauces were enlarged and flabby as if they had been the seat of a recent inflammation.

In this case it was evident that the throat and bowel disease commenced simultaneously, the appearance of the bowel being such as we should witness about the third week of the disease in the severest cases.

The converse of the above case—the development of scarlet fever where enteric fever is raging—occurs very frequently, and the reports of our sanitary officers furnish frequent instances. My friend Dr. Thompson, of Ulverstone, has the following in his report for the year 1886 :

In May a fatal case of enteric fever took place at Bardsea—a little detached hamlet—arising from polluted water, and in November a boy was attacked with the disease subsequently and on the opposite side of the road ; when the boy was recovering, his younger sister had a sharp attack of scarlet fever. "I made," Dr. Thompson continues to say, "careful inquiries, but failed to discover that there was any scarlet fever in the neighbourhood."

In further illustration of this subject, I would call attention to the frequency with which sore throat occurs at the onset of enteric fever. The evidence of this will not often be found in the clinical records, for as the patients do not generally come under observation until the second or third week of the disease, the earliest symptoms are usually forgotten—eclipsed by the graver symptoms which follow. In some cases indeed the faucial or laryngeal symptoms may continue to be very prominent to an advanced stage of the disease ; but the evidences are mainly to be found in the post-mortem room.

Looking through my cases of enteric fever, the first that arrests attention is No. 12. It is one in which the symptoms of scarlet fever and enteric fever are both prominent.

A male, aged 21, was taken ill with sore throat and cough, which grew worse. Diarrhœa appeared on the 7th and continued to the 15th day, when he was admitted with a distinct, but apparently fading scarlatina rash, and inflammatory swelling of the tonsils. The throat became worse during the next eight days, and on the 23rd day hoarseness and a tracheal cough appeared. The motions were pale and pasty, but he had no diarrhœa after admission. He died on the 29th day of perforation 2 feet above the valve. Peyer's patches throughout the lower third of the ileum

were deeply ulcerated. The pharynx and its glands were swollen, and the mucous membrane ulcerated in the lower half. The edges of the epiglottis and arytæno-epiglottidean folds were also ulcerated, and there was a deep ulcerated cavity above one of the true vocal cords, and behind the poculus laryngis. The kidneys were congested; the spleen weighed 17 oz.

Cases 101 and 123, both children, were admitted with slight œdema of the subcutaneous tissue, a trace of albumen, and enlargement of the glands below the angle of the jaw. One at least was taken ill with sore throat, the tonsils became greatly swollen and a little ulcerated, and there was a purulent discharge from the nostrils.

Cases 95 and 125 began with tonsillitis.

Case 77 had laryngitis and aphonia for a month, and on admission there was one-seventh albumen in the urine. His attack was a severe one, being admitted on the 21st and discharged on the 95th day.

In 17 other cases "sore throat" was the most prominent of the early symptoms.

In 10 other cases there was purulent discharge from one or both ears, and in some it was very profuse and prolonged.

I could extend this evidence of the close association of enteric and scarlet fevers much further, but I think it will be granted that I have adduced sufficient to convince an unbiassed mind. Others may feel compelled to grant it too; but many, I dare say, will evade the issue by evoking the fancied objection that all such evidence is proof of nothing more than the coexistence of two distinct diseases. This objection proceeds on the assumption that a particular set of symptoms constitutes the disease, which we know is not the case, for any one of them may be absent without destroying its identity. The outward symptoms are but the mere accidents of the disease. We have already wasted much time over these, and in our desire to dogmatise have thoughtlessly ruled out the affinities which Nature has implanted, and thus dissociated diseases which

are sequent and mutually interdependent. If I have succeeded in proving that enteric fever has the affinities for which I have contended I shall be satisfied. A proper classification in which this is recognised is sure to follow.

I will now devote the short time remaining to the consideration of the treatment of enteric fever.

The troubles which actually afflict the distressed patient and those which threaten on every side are indeed enough to discourage, if not to disarm, the physician. Many, indeed, of us stand aside expecting, and do no more than strike at a head of this hydra if it should happen to be projected. They do not presume to attack the monster himself. Such a practical denial of our inability to cope with the disease is unbecoming, for it is not warranted by the circumstances.

Our first efforts should be directed to the restoration of the functions of the skin, for in proportion as this is effected, so will the pyrexia decline.

Ordinary sudorifics seem to be of little avail, but we must not therefore neglect their use, for slight aid in two or three directions will co-operate beneficially.

Thirst is often present, and we may combine the sudorific, such as citrate of ammonia, with an effervescent draught.

But the most hopeful means of arousing the action of the skin is the application of large hot linseed poultices to the trunk, especially to the abdomen.

It might be thought that the application of moist heat to the whole of the surface would secure the desired effect, but such a proceeding, as Dr. George A. Carpenter has shown,[1] is attended with danger. In one case the temperature rose from 99° to 105° F., falling when the pack was removed to 102·2°, and on its renewal rising again in three-quarters of an hour from 100° to 104·2° F. In another case the temperature rose in the course of about sixteen hours from 102·2° to 107·2° F.

[1] "Dangers of the Continued Hot-water Pack in Acute Renal Disease," 'Practitioner,' September, 1888.

Physiological facts appear to have been disregarded in the use both of the hot- and cold-water bath in enteric fever. The facts which have been conclusively proved are these—

As to heat—

(1) The application of cold to the surface increases the heat of the internal organs and of the blood; and *vice versâ* the application of warmth decreases the internal heat; but—

(2) The external heat must be dry; if it be moist—even air laden with moisture—then it fails to diminish the internal temperature.

As to water—

(3) When air-breathing animals are immersed in water, either cold or hot, there is of course an arrest of the sudoriparous function, and probably of the respiratory function too. Consequently there is an accumulation within the body, both of heat and of carbonic acid.

(4) The natural functions of the skin being thus suspended, it is reduced to the condition of an osmotic membrane, the flow necessarily being inwards, and water passes into the vessels.

The effects of bathing, either warm or cold, are therefore to increase, firstly, the internal heat, and secondly, the congestion of the vessels by the imbibition of water.

Dr. G. Johnson has observed that albuminuria is an occasional result of cold bathing, and I have myself so frequently observed albuminuria follow the use of the hot bath during convalescence from scarlatina that I have discontinued this practice.

In enteric fever the conditions are so far different that the sudoriparous and respiratory functions of the skin are already diminished or abolished: the production of heat goes on very rapidly, mainly at the expense of the tissues, and it appears that the only outlets are by radiation and the excreta—including the exhalation from the lungs.

We have seen that the increase of heat in the normal body is due to the arrest of the sudoriparous function,

but as this is already in abeyance in enteric fever, the effect of the cold bath in this direction may be disregarded. On the other hand, there cannot be a doubt that the cold bath increases the internal congestion, both by causing the influx of water through the new hygroscopic skin, and by the constriction of the cutaneous blood-vessels. The shivering and chattering of the teeth induced by the immersion is pretty conclusive evidence of this, and the effect upon the already severely congested lungs and intestines during this paroxysm is enough to make a physiologist shudder at the bare idea. To treat a poor patient thus is verily to "give him a hair of the dog that bit him."

If it were possible to convert the continued fever into a truly intermittent form, with the paroxysms each ending in a copious sweat, I should be bound, in spite of the breach of physiological laws which the treatment involves, to acknowledge that the proceeding was a beneficial one, but when I find that no such restoration of the action of the skin follows upon this artificial production of the rigor, I fear its worst results.

As I have not dared to employ this treatment in my own cases, I must turn to the evidence supplied by other observers.

In treating of this topic in his Croonian Lectures Dr. Cayley adduced the practice of Dr. Brand, of Stettin, as showing the most favourable results. Dr. Cayley will forgive me, I hope, when I suggest that there is a fallacy underlying the evidence. This Dr. Brand collected 8141 cases which had been treated anti-pyretically, the mortality amongst which amounted to only 7·4 per cent.

Turning to his own special experience of 121 cases treated in the military lazaretto at Stettin, 5 of them died, giving a percentage of only 4. In private practice he treated 211 cases in succession, without a single death; but—and here lies the fallacy—these cases, the private ones at least, were placed under the antipyretic treatment "*from the very commencement* of the disease."

Now who amongst us shall presume to say that a given

case of continued fever a week old is enteric fever—fever attendant upon an intestinal lesion, and not a mere diarrhœa?

A multitude of such cases come under treatment. We suspect they may be suffering from enteric fever, and possibly under adverse circumstances a good many of them might drift into this condition, but as a matter of fact they are convalescent in a week or nine days, and we properly exclude them from the category of enteric fever and place them in that of "*febricula.*" I cannot therefore regard a tithe of Dr. Brand's patients as subjects of enteric fever.

Generally speaking, recovery will always bear some proportion to the time when the patient first came under treatment.

Turning to my own cases, I find that:

Of 72 cases admitted during the first week (32 were admitted on the 7th day), 2, or 2·7 per cent., died.

Of 87 cases admitted during the second week (44 were admitted on the 14th day), 9, or 10·34 per cent., died.

Of 42 cases admitted during the third week (31 were admitted on the 21st day), 9, or 21·4 per cent., died.

Of 6 cases admitted during the fourth week, 2, or 33 per cent., died.

Of 18 cases admitted during the fifth week 1, or, 6 per cent., died.

Of 7 cases admitted between the 5th and 12th weeks, 3, or 43 per cent., died.

Total number of cases, 232. Total number of deaths 26, = 11·2 per cent.

Of 159 cases admitted during the first and second weeks (32 in the 7th and 44 on the 14th day), 11, or 6·9 per cent., died.

The rates of mortality given in this table compare very favourably with the experience of those who have employed the cold bath. Thus, in the 23 cases treated by Dr. Ord,[1] 6 died, giving the high mortality of 26 per cent.

[1] 'St. Thomas's Hosp. Rep.,' vols. viii, ix.

Of the 130 cases (44 of which were fully and 86 only partially treated by the baths) treated by Dr. Cayley, 18, or 13·8 per cent., died.

Of Dr. Sidney Coupland's 89 cases, 56 of which were treated by the cold bath, 7 died = a mortality of 7·8 per cent. Of the bathed cases alone, 56 in number, 5 died = 8·9 per cent.

One of my own cases—a fatal one—was treated by the cold bath. The following are the particulars :

Ellen B—, aged 24, was admitted on the 14th day with a temperature of 104·2° F. Between this date and the 20th day cold spongings were used 21 times. They generally reduced the temperature 1° or 2° for an hour or two, but twice not at all, and once it rose from 104° to 104·4° F. within half an hour after the sponging. Once the temperature fell 3·2° within half an hour, but after 2½ hours it had risen to 3·4°, *i. e.* higher than it was before the sponging. After the 20th day the temperature declined, and between the 24th and 32nd days it remained normal. On the 43rd day a relapse occurred, and between this and the 59th day the patient had 20 cold spongings. On two occasions the temperature fell in the course of an hour 4·4°—from 105° to 101·6° F. After all the other spongings it fell 2° or 3°. She died on the 62nd day of perforation 10 inches above the valve. The lungs were œdematous.

In reference, then, to attempts to reduce the fever by cold baths or sponging, I find physiological principles are against the practice, and that the statistics of those who have adopted this treatment give, in no case, positive sanction, while in one the results are prohibitive.

The advocates of the apyrexial treatment seem to imply that a temperature of 104° F. is a dangerous one, but when I turn to the records of my successful cases I find that 125 out of 232 of them, or more than half, had a temperature of 104° and upwards, reaching in many to 104·8°, and 39 of them registered 105° and upwards;

8 of them attained 105·4°; 7 of them 105·6°; and 1, 106° on three consecutive days.

In some of these cases the high temperature persisted for several days: thus in Case 30, Amy L—, aged 16, the maximum temperature on the 7th and following 16 days was 104°, 105°, 105°, 105·6°, 104·4°, 105·2°, 104·2°, 104°, 104·2°, 103·8°, 102·4°, 101·4°, 100·6°, 103°, 104°, 103·8°, 102·6° F. In Case 62, that of a female, aged 52, the daily maximum between the 21st and 28th days inclusively was 104·6°, 104·2°, 103·4°, 103·6°, 104°, 104·4°, 104°, 102° F. Case 71, a male, aged 21, was admitted on the 11th day with a temperature of 105·8° F., and between this and the 37th day, a period of 24 days, the maximum was as follows: 106°, 106°, 106°, 104·6°, 104·8°, 104·4°, 105°, 104·2°, 103·6°, 103·6°, 104·4°, 105°, 105·8°, 105·2°, 105°, 104·6°, 105·2°, 104·8°, 102·8°, 103·6°, 104·2°, 103·4°, 103·6°, 102·4° F.

Amongst my cases of recovery there are at least six more (103, 108, 113, 114, 139 and 143) illustrating the the same fact.

These cases were of course severe ones and required the most delicate handling; and I would much prefer leaving such cases to Nature than that they should be exposed to the "*minia diligentia medici.*"

Before I dismiss the skin and its sudoriparous function from consideration I would say a word or two about alcohol.

I have found its moderate use in severe cases beneficial. I believe that, as a part of its general stimulant action, it tends to excite perspiration, and I have prescribed it with this view as an adjuvant to ordinary diaphoretics. We are apt to give it too freely, forgetting that some of the patients for whom we prescribe it are unaccustomed to its use. For these I think 2 ounces in the twenty-four hours is usually sufficient. As a sudorific I believe the use of larger doses would often defeat this effect.

An important part of the treatment of enteric fever applies to the liver. I have insisted upon the very positive evidence which we possess of the poverty of the

bile and sometimes of its complete absence. Our efforts should therefore be directed to the revival of the hepatic function, or generally perhaps the stimulation of its failing powers, and to introduce at the same time some remedy into the intestinal canal, which, by supplying the place of the bile, may prevent the putrid decomposition of its contents.

For this double purpose I employ a non-irritant preparation of mercury, and in order to secure its action combine it with opium, which is always needed in the treatment of enteric fever.

The formula which I have employed is the following:

Hydrargyri cum cretâ . .	gr. iss to ii
Pulveris ipecacuanhæ compositi .	gr. ii to x

Fiat pulvis, nocte manigne sumendus, the smaller dose for children, the larger for adults.

156 of the total 232 cases of enteric fever have been thus treated. The one-third of the cases which were not so treated were accidentally, so to speak, excluded, the diagnosis in some being obscure, and other treatment having been adopted by my assistants, and in which I was glad to concur, inasmuch as it furnished opportunities for comparing the mercurial treatment with other methods.

It is, however, correct to say that the 156 cases include generally the most severe cases, and that the test has been rather severely applied.

I supplement the above by increased doses of opium, and the use of large doses (gr. x to xv) of quinine as occasion requires.

I give the powder (in milk) from the earliest to the latest stage of the disease, irrespective of any complications which may exist at the outset, or arise subsequently. Excepting perhaps with vomiting, it is incompatible with none of these, and I continue the remedy when diarrhœa and even hæmorrhage supervene, giving such additional remedies as may be needed.

It is quite remarkable how long the dose may be taken regularly twice a day without the occurrence of mercuria-

lism. I have often, as the following abstract will show, given it for a period of 30 days or more, quite including the period of convalescence when the patient was up and eating fish, with a clean tongue and voracious appetite. This observation, however, was merely tentative, the powder having been usually discontinued when the time came to order fish and a chalybeate tonic. In only a very small proportion of cases, less than 4 per cent., was mercurialism induced, and in these cases the symptoms were so slight that they subsided with the aid of an astringent wash in the course of a week.

Time during which the combined mercurial and opium treatment was continued :

2	days	in	1	case.	20	days	in	5	cases.
4	,,	,,	5	cases.	21	,,	,,	7	,,
6	,,	,,	3	,,	22	,,	,,	10	,,
7	,,	,,	4	,,	23	,,	,,	7	,,
8	,,	,,	3	,,	24	,,	,,	4	,,
9	,,	,,	4	,,	25	,,	,,	3	,,
10	,,	,,	8	,,	26	,,	,,	4	,,
11	,,	,,	7	,,	27	,,	,,	4	,,
12	,,	,,	5	,,	28	,,	,,	2	,,
13	,,	,,	5	,,	30	,,	,,	13	,,
14	,,	,,	12	,,	31	,,	,,	2	,,
15	,,	,,	7	,,	34	,,	,,	4	,,
16	,,	,,	6	,,	36	,,	,,	3	,,
17	,,	,,	4	,,	37	,,	,,	1	case.
18	,,	,,	6	,,					
19	,,	,,	7	,,				156	cases.

Under 1st week . . .	9	cases.
Between 1st and 2nd weeks .	36	,,
,, 2nd and 3rd ,, .	47	,,
,, 3rd and 4th ,, .	39	,,
,, 4th and 5th ,, .	21	,,
Above 5 weeks . . .	4	,,
	156	

Average time for the 156 cases—19½ days.

In most of the cases constipation prevailed throughout, so that the mercury cannot in these cases be regarded as eliminative. As to its absorption there can be no doubt, for when I first adopted the treatment in the London Fever Hospital twenty-three years ago I prescribed larger doses, sometimes as much as 5 grains twice a day, and in these mercurialism was an early and prominent effect.

The result of the treatment, as far as I am able to judge, is to evoke an earlier reappearance of the bile than happened in cases not so treated. I am unable to say whether the mercury is stored up in the liver during the pyrexial period. It may be so, and that it is gradually eliminated when the biliary function is re-established.

Before I place before you the results of this treatment, it will be convenient to conclude what yet remains to be said as to general treatment.

Constipation is often present—indeed, in my cases at St. Thomas's more often present than diarrhœa, and it has been necessary to combat this by the use of simple enemata every second or third day, and sometimes by the use of small doses of castor oil.

When diarrhœa is at all severe I wash out the bowel once or twice a day with warm water containing 1 per cent. of carbolic acid, a pint or more being carefully used. It gives great relief, and by correcting putridity protects the mucous membrane.

I have already spoken of poultices applied to the abdomen. This is a portion of the treatment which I never omit, excepting in slight cases. The abdomen should be covered with a soft linseed poultice firmly applied by means of a flannel roller, so as to support the abdomen. It is rarely complained of, but on the contrary is found to be a great comfort. I regard it as an effectual mode of relieving the local inflammation, and of preventing tympanites.

The result of the mercurial treatment is given below. The figures speak for themselves, and compare very favourably with the general hospital statistics of enteric fever

and those of St. Thomas's Hospital, generally for the period during which the observations were made, and which show a mortality of 15 or 16 per cent.

Mercurial treatment began.	No. cases.	Died.	Mortality.
Between 1st and 7th day inclusively	36	0	0
„ 8th and 14th „ „	62	4	6·4%
„ 15th and 21st „ „	30	8	26%
„ 22nd and 28th „ „	14	2	14%
„ 29th and 35th „ „	10	2	10%
After 5th week	4	0	0
	156	16	10·2%

Case 215 admitted on 61st and died on 66th day, treated 4 days } are
„ 216 „ „ 50th „ „ „ 60th „ „ 5 „ } ex-
„ 234 „ „ 26th „ „ „ 31st „ „ 2 „ } cluded.

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ON THE

ACTION AND USE OF ACONITIA.

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The following observations have been made, firstly with the view of elucidating the precise action of aconite; and, secondly, of ascertaining whether or not it exercises any control over the febrile state. The pure crystallized aconitia of Mr. Morson, or of Messrs. T. and H. Smith, of Edinburgh, was employed in every case.

On the Horse.—The subject of this and the two following experiments was a weakly brown colt of the pure race-horse breed.

Observation 1.—The pulse being 48, of good volume and power, and the respirations 7, $\frac{1}{100}$ of a grain of aconitia dissolved in rectified spirit was injected under the skin of the shoulder.

After *one hour* there was no change except a falling- or sucking-in of the false nostril at each inspiration.

After *two hours* the pulse was accelerated ten beats; it was strong, full, and irregular. The respirations and pupils were unchanged. The falling-in of the false nostril at each inspiration continued; it was marked by a linear depression of the external skin corresponding to the false nostril, and there was manifestly a slight impediment to the entrance of air. The

dilator of the nostril was evidently paralysed, for there was no tendency to retraction when the part was supported by the finger. The skin and mucous membrane about the nasal orifices were not sensitive to the prick of a pin.

After *seven and three quarter hours* (midnight) the horse was lying down in his box apparently comfortable. Pulse 48, of initial volume and power; the lips, gums, and tongue dryish. He had continued to munch a little hay throughout.

In this observation two effects were observable:—1. Palsy of foremost inspiratory muscle, the dilator narium; this was the earliest symptom, and was rendered apparent by an impediment to the inspiratory act in the chest itself, but which was too slight to cause any other appreciable effect on the respiration. 2. Increased arterial pressure, due to the same respiratory impediment.

Obs. 2.—After an interval of a month, the pulse being 48, and the respirations 7, as before, the $\frac{1}{50}$ of a grain of aconitia dissolved in ♏xx of rectified spirit was injected. The animal dunged immediately after the needle was withdrawn.

After *one hour* palsy of the dilator narium as before. Pulse 50, increased in volume and power. Continued to eat, and did not seem much affected; but there was great irritation at the seat of puncture, for the horse frequently bit at it.

After *an hour and a half* pulse 60, full and strong.

After *three hours* pulse 68, full and strong; there was thirst and the horse drank a pailful of water; had dunged a second time. Stood very quiet.

After *six and a half hours* lay down quietly in his stall. Pulse 52, regular, but weak; respirations 6 to 8, unequal and irregular; false nostril collapsed. Champed a good deal, and a considerable quantity of frothy mucus flowed at intervals slowly from the mouth. Had dunged and passed urine, but now refused both hay and water, and was evidently weak, allowing both the head and ears to hang down. He raised himself without trouble, but then stood stock-still; was quiet and dull, and, though naturally irritable, allowed me to pinch his skin. He continued in this state up to the end of the *eighth hour*.

The next day, after an interval of *eighteen hours* from the time of injection, he seemed quite recovered, but the pulse was 40 and decidedly weak.

In this case the chest movements were appreciably affected; the respiration was impeded; the cardiac acceleration and arterial pressure were proportionately increased. When the effects of the aconitia had ceased, the result of increased cardiac action and prolonged tension was indicated by feebleness of the pulse. It is doubtful whether the apathy on pinching the skin was due to anæsthesia or to the indifference of languor; from further observations I am inclined to attribute it to the latter cause. General muscular weakness was very marked. Thirst at the end of the third hour, no doubt, indicated congestion of the gastric mucous membrane. The subsequent refusal of water was probably due to lingering spasm of the gullet (see next *Obs.*). The excretions were normal.

Obs. 3.—After a long interval, the pulse being 50, and the respirations 8, the $\frac{1}{24}$ of a grain of aconitia dissolved in ♏ xx of rectified spirit was injected. No change took place until the end of *an hour*, when the falling-in of the false nostril was observed.

Ten minutes later the respirations fell to 5, and the inspirations were long drawn; there was a rumbling of air and water in the abdomen. Pulse 56, stronger.

After *an hour and a half* the pulse was 68, full, regular, and soft; some beats even feeble; the inspirations were sudden and spasmodic, and the expirations slow and laboured, but not audibly so.

Ten minutes later the horse was restless, walking and turning about, and making an audible noise in expiration from vibration of the nostrils. Respiration 5, irregular; two deep inspirations, then a long pause of one third of a minute, followed by two inspirations and another pause.

After *an hour and three quarters* restlessness and distress, with diminution of muscular power indicated by a tendency to stumble or totter.

After *two hours* the slow, irregular breathing which had continued to the present time was now succeeded by great

rapidity, and the horse panted like a winded dog with occasional suspensions, corresponding probably to the pauses noticed in the slower breathing. The animal now broke out into sensible perspiration and dunged thrice. The pulse was 84. There was further diminution of muscular power; he was quite conscious and very sensitive.

Ten minutes later, after much stumbling, he fell down, and the respirations were reduced to 5. He attempted to rise, but for a while could not, and sat on his haunches, and then, after a desperate effort, regained his legs.

Five minutes afterwards he was seized with an intense spasm of all the voluntary muscles, rendering the legs rigid, and raising him for a moment on his front toes; the breathing was stridulous, the pulse so small and rapid that I could not count it. When the muscles relaxed he stumbled and fell, and then the respiration, although greatly accelerated (68), became deep and free, and he lay quietly, bathed in sweat, and did not regain his legs again for five and a half hours.

After *two and a half hours* ropy saliva began to trickle from the mouth, and seeming attempts to swallow it caused retching. Pulse 40, very feeble. Respirations about 68, panting, and not quite regular; excessive prostration.

After *three hours* the pulse was still further reduced to 30, and was very feeble; the respiration continued slightly spasmodic and about 65.

After *three and a half hours* the breathing became slower and freer, and the pulse rose to 80, but it was still very small and feeble. Occasional attempts to swallow produced great choking and general spasm, but in the intervals he lay very quiet.

After *four hours* the respirations were reduced to 24, and the inspirations were regular and full drawn, occasionally interrupted by a succession of short, panting ones. The pulse rose to 84, but remained very feeble and compressible. The profuse sweating which had continued for nearly three hours was now ceasing; the abdomen and hind quarters alone were clammy, and the skin was everywhere warm. There was still much distress, but now associated with deglutition. During the following hour he dunged twice; there was much rumbling, and very large quantities of wind were passed.

After *six hours* he still lay helpless as before on the side, too

feeble to raise a limb. The respirations 36, shallow, and the inspirations at times still panting. The pulse 60, regular, effaced by the slightest pressure, and some beats very faint. At this time a little water was placed in his mouth by means of a sponge, and it produced for some seconds the most violent choking spasm and intense distress, so that he struggled to get up and kicked about in a state of desperation in order to draw air into the chest, but none entered, and he fell back exhausted. The pulse rose to 120, then relief came with a decided hiccup, and the inspirations followed regularly at the rate of 24 a minute, alternating with long, grunting, laboured expirations, the intercostal spaces being wide enough to receive two fingers, and for several minutes at a time undergoing neither contraction nor further expansion. He continued in this state for the next hour, the pulse beating 60 regularly as to time, but very irregularly as to force, some beats being pretty full, but followed by five or six beats very faint and indistinct. The respirations rose to 36.

After *eight hours* the respiration was freer, and the pulse improved in power. At this time he regained his legs, stood with some difficulty, evacuated both the bowels and bladder, and ejected some clear glairy fluid from the nostrils. During the next hour he stood still with the head drooped; the pulse much fuller and the beats of equal power, but still very soft and compressible. The intercostals were now acting well; the respirations 40, with a faint, blowing, expiratory sound like that of a horse after a hard run. Skin hot and dry; the ears damp. The mouth was closed throughout, and on now opening it the muscles of the jaw resisted somewhat, and some glairy mucus ran from the mouth. The tongue was normal. At intervals of a few minutes the regularity of the breathing was interrupted by a sigh-like inspiration, followed for a few seconds by short, rapid breathing, 70 to 80 a minute, and then falling to 40 again, and becoming regular.

As often as a little water was offered it was refused, and it provoked a slight spasm of the throat and the panting respiration just described.

From this time recovery was progressive; during the night the evacuations of the bowels and bladder were free, but the motions were not loose. Next morning, *eighteen hours after* the

aconitia was given, the horse was comfortable but very quiet, the respiration was normal, the pulse 55, regular, but small, feeble and compressible. The tongue, pupils, and mucous membranes were normal, the skin warm and sensitive. He had refused food previously, but now accepted it.

The pupils were unchanged throughout, consciousness completely retained, and the skin highly sensitive. The dung passed during the latter part of the time was rather pale, of disagreeable odour, softish, and contained undigested oats.

In this case the dose proved very nearly fatal. The symptoms appeared in the same order as in the preceding observations, and almost the whole of the effects are attributable to the respiratory difficulty caused by intermittent spasm of the muscles attached to the upper part of the chest, and of those of the respiratory passages, rising to great intensity at intervals; while the muscles of the rest of the chest wall, excepting the diaphragm, were generally in a state of incomplete palsy. The diaphragm was evidently for the most part in an enfeebled condition, but sometimes the action was aroused, and once, at least, became spasmodic. The heart throughout indicated the degree of hindrance to the breathing; the dyspnœa at first causing increased cardiac action and arterial pressure, and when the inspiration was greatly retarded, intermission of the former. As often as the breathing became free, the pulse fell, and then indicated by its flaccidity the immense strain of which the heart had been relieved. But we have here evidence of spasm of the gullet also, indicating the general implication of the pneumogastric nerves. The symptoms referable to this cause are closely akin to, if they be not identical with, those which characterise hydrophobia. The muscular weakness was excessive, but did not amount to paralysis, for the struggles were violent when the choking spasms came on. The skin appeared highly sensitive throughout, in the earlier stage the settling of a fly caused vibration of the cutaneous muscle.

The following case completes this series.

Obs. 4.—The subject of this experiment was a sturdy grey entire horse, about fourteen hands high. The pulse 38, and respirations 8.

Half a grain of aconitia dissolved in f3j of rectified spirit was injected into the loose areolar tissue behind the shoulder. The injection caused irritation in the part.

After *half an hour* the pulse was 44 and stronger.

After *one hour* he began to be restless and champed, and suddenly began to froth at the mouth, and to slobber freely, and a minute later strong spasm of the glottis and windpipe came on, and the long-drawn inspirations were audible. Once he made an effort to swallow the frothy mucus, and it immediately brought on a severe choking spasm of the glottis, as if it were completely occluded by a foreign body; the head was drawn backwards, the muscles of the neck becoming very rigid. After this passed off the pulse was 48, increased in volume and power. Respirations 10, the lower ribs being very powerfully drawn in during inspiration. He dunged twice, and now began to stagger.

During the next ten minutes, the inspirations became audible, being accompanied by a low faint snore, the slobbering continued, and, the inspirations becoming rapidly more difficult, suffocation seemed to threaten.

After *one hour and ten minutes* from the time of injection a canula was passed through the skin into the trachea. It gave no relief, although the air passed through it freely. Five minutes later, the inspirations were reduced to 8, and a violent suffocative paroxysm came on, in which the horse tottered and fell. After a few seconds, and with great effort he regained his feet, when the respirations were 40 and deep, and he was wet with sweat. In the course of five minutes, the breathing again became stridulous, and he fell down a second time. As he lay the inspirations were 28, full and deep, and some wind was passed from the bowels. He regained his legs for a few minutes, and fell down a third time, never to rise again, and lay upon the side with the legs straight out, the respirations varying from 32 to 22, each inspiration being attended by a long-drawn whistle of low pitch, and a good heaving of the chest and abdomen. The pulse 86, full and strong.

During the next half hour the respirations and pulse continued to rise, and it appeared as if the chest was retained in the inspiratory expansion, and the diaphragm alone acting efficiently, and slowly heaving the abdomen.

After *two hours* the breathing was 40 and difficult, the inspirations and expirations being attended respectively by a sudden tuckling in and flapping out of the abdominal walls as if the diaphragm was now paralysed. The pulse had risen to 136, and it still remained as before, regular, strong, and hard.

Twenty minutes later the respirations were reduced to 20, and were very shallow; in a word there was extreme orthopnœa; the teeth were firmly clenched at each inspiration, and the air was forced out of the chest by prolonged and very forcible contraction of the chest and abdomen. After continuing thus for twenty minutes this evident obstruction of the air passages was suddenly removed, and the inspiratory muscles, as if set free, responded fully, and the respirations were doubled in number and frequency, the inspirations were very full and snoring from vibration of the nostrils, and the expiration was a forcible loud blow. This easy state of matters did not last long, the breathing became slower and shallower, the pulse became irregular, two or three violent beats and then a long pause, and both rapidly failing, the animal died two hours and forty minutes after the injection of the aconitia. Consciousness and common sensation were retained to the minute of death. The pupils were unchanged throughout.

The chest was opened within ten minutes of the death of the animal. The lungs were completely collapsed behind the heart, perfectly healthy, of a pale rose colour, and, excepting the upper lobe of the right, increpitant; on opening the pericardium, a faint quiver affected the heart; the left cavities were firmly contracted and contained only a little dark blood, the muscle of the ventricle was quite hard. The blood was chiefly contained in the right heart and the great vessels connected with it, the veins and the auricle being enormously distended. No attempt was made to revive the pulsation of the right heart, as the great vessels were divided at once. The blood was very dark, and coagulated very soon.

The stomach contained about six pints of bright, clear, glairy, and very acid fluid. The œsophagus throughout its whole length was like a hard rope; its passage, including the cardiac orifice of the stomach, was so firmly occluded that it gave as much resistance to the passage of the index finger as a new kid glove. The glottis was open; the muscular fibres of the

diaphragm were flaccid. Rigor mortis had not come on an hour and a half after death.

Here we have a case of intermittent suffocation, the symptoms being precisely similar to those of the preceding case, but the spasms were more violent, and recurred more frequently. The introduction of the canula gave no relief because the air tubes below were in a state of constriction, and the action of the diaphragm only increased this, and at the same time produced collapse of the lower part of the chest walls.

On the Dog.—The subject of the following experiment was a young sheep-dog weighing twenty-one pounds; the medicine was given fasting.

Obs. 5.—$\frac{1}{200}$ of a grain of aconitia contained in ♏v of dilute alcohol was injected beneath the skin. Within eight minutes he was restless and whined, apparently from local irritation.

After *fifteen minutes* began to cry piteously and then retched violently, with emission of urine. Then there was an interval of quiet, the respiration 12, and the heart throbbing strongly, followed by struggling and retching, the hind legs losing power. From this time up to within four minutes of his death, thirty-eight minutes after the injection, the poor dog was in the most terrible distress; there was inability to stand, and if, as happened once in the earlier stage, the body was sustained on the legs for a moment, these were outspread and greatly tremulous, and in the paroxysms he crawled frantically on the belly, beating the forepaws on the floor. The paroxysms succeeded each other very rapidly, and consisted apparently of violent retching, the head being either strongly retracted or bent downwards, and the lower jaw forcibly depressed; the widely opened mouth was purple and stuffed with frothy adherent mucus; the ineffectual expulsive efforts were followed by the most distressing cries. *Thirty-three minutes* after the injection the cardiac beats were 110 to 120, regular and strong; the respiration 12. After this time the breathing seemed to consist in the retching efforts, and finally after two inspirations, separated by intervals of half a minute, the respiration ceased; the pupils at this time were dilated. Consciousness was retained throughout, and the poor

animal seemed to seek my help in the paroxysms, and in the intervals feebly turned his head, and wagged his tail when spoken to. The pupils up to three minutes before death were normally contracted—unaffected—afterwards they were completely dilated.

I examined the body five minutes after death; on lifting it by the arms from the floor to the table, air entered the lungs; the body was flaccid, the chest collapsed, the concavity of the diaphragm lay very high; on puncturing an intercostal space, air rushed into the chest cavity. The lungs were of a pale red-lead colour, and partially collapsed. The right heart and the large vessels connected with it, as well as those at the roots of the lungs, were enormously distended; on relieving the distension of the auricle a very little by pricking the superior cava, this cavity began to contract regularly sixty times a minute, and continued to do so for twenty minutes. The left heart was firmly contracted, and contained only a teaspoonful or two of dark venous blood. All the blood was very dark, and the temperature of that in the inferior cava, twenty minutes after death, was 105° Fahr. It coagulated almost immediately. The œsophagus, stomach, intestines throughout, and the bladder, were completely occluded by hard contraction. The mucous membrane of the stomach, like that of the mouth, was dusky purplish, the edges of the rugæ being darker, from congestion, and covered with a frothy, very tenacious mucus. There was only one (right) kidney and ureter; the bladder end of the abortive ureter formed a white fibro-fatty mass about one inch long by a quarter of an inch wide, ending in a smooth round free end. The gall bladder was full of healthy bile.

Rigor mortis came on within an hour.

Intermittent suffocation is the leading feature in this case, when the swift action of the poison had reached its full violence. The terrible paroxysms, of which there were six or seven during the last five minutes of life, and which seemed to be retching, were really ineffectual efforts to draw air into the chest and to expel that contained in it. The motor branches of the vagi, radiated inflexible cramp on the respiratory and alimentary ways indifferently, and this was only interrupted when the asphyxia which it produced was so complete that the excited

nerve centres could no longer find food for their extravagant action. The spasm relaxed, the blood was soon again sufficiently revived for the generation of a fresh torrent of nerve force, and this in a little time found vent in another spasm. As soon as the respiratory difficulty began, restraint was placed on the right heart and it battled well for a time, but towards the close of each suffocating paroxysm it was distended almost to bursting. So long as the animal could take an effectual inspiration, the paralysing pressure was removed, and it resumed its action. At first strong, it laboured mightily to overcome the obstruction, but lost power after each violent exertion. The muscles of inspiration were, however, the first to fail, the chest-walls fell in, the relaxed and dilated air passages no longer offered impediment to the egress of air, and the lungs collapsed by virtue of the resilience of their elastic tissue. The heart, meanwhile, unrelieved of its load, was still or only faintly quivering, and yet ready to resume efficient action when room was given by venesection for its exertion.

On the Cat.—*Obs.* 6.—The following instructive case completely illustrates the full effects of aconitia and complete recovery from them. The subject, a vigorous kitten fourteen weeks old, weighing nearly three pounds, very nearly succumbed to the $\frac{1}{1000}$ of a grain of the alkaloid injected in ℥v of water beneath the skin.

After *fifteen minutes,* having previously been still and comfortable, slight spasm of the larynx came on, the head was forcibly pushed forwards several times, the neck outstretched, and inspiration accompanied by a faint stridulous noise. This continued for a few seconds, and was followed by working of the jaw.

During the next ten minutes she had three similar attacks, but throughout maintained her position, and was quiet, and apparently comfortable in the intervals. At the end of this time a fifth and stronger attack impelled her to start away in a reckless manner and with an angry cry, and she sat on the haunches, breathing irregularly, 60; the inspirations being short, catching, and with a few considerable pauses. Three minutes afterwards (the thirty-third minute) she had another attack.

After *forty minutes* the respirations were reduced to 6, and the intervals of inspiration were sometimes so long that it appeared as if the breathing would be soon arrested; the head was curved forwards and on the ground, the tongue protruded from the opened mouth, and slightly drawn in with each inspiration, and there was occasional twitching of the facial muscles.

During the next thirteen minutes, and after a seventh spasm, the respirations were 60, each inspiration being a little snatch, which moved the whole body just as the foot is raised by the popliteal artery when the ham of the same leg is placed on the knee of the other. Then for two minutes the respirations were suddenly reduced to 14, and became irregular again; each inspiration was a little snatch which jerked the body forwards, without, however, permanently disturbing the balance, until the inspiratory difficulty reached a certain point, and then the animal was suddenly impelled forwards in a desperate scramble. After the last of three of these attacks, each equalling in severity those which follow larger doses of the poison (see Obs. 5), and each attended by a most savage agonising cry, the poor little animal got a sudden relief to the breathing, the respirations rising to 100, good panting movements of the abdomen, and no longer jerking the body. As she lay on the carpet with the legs outspread, mewing feebly at first, the pants became slighter and less frequent, and at the end of *an hour and a quarter* from the time of injection were reduced to 24.

During the next twenty minutes she remained in the same state; her quiet being only once disturbed by a spasm (the eleventh), after which the respirations were 20. At the end of this time the respirations were 25, and it appeared that a considerable improvement had taken place in this function, for two or three successive inspirations were well drawn by strong laboured contractions of the diaphragm. This, however, did not bring the relief I expected, but, on the contrary, distress; and it was soon apparent that the diaphragm was holding an unequal contest with the expiratory muscles, including, no doubt, those of the air-tubes and larynx; for this action had not continued a minute before one of these laborious, but ineffectual, descents of the diaphragm provoked a forward rush and cry of anguish.

During the next half hour this was repeated thrice, and then the laborious action of the diaphragm was only occasionally repeated. The breathing generally being 17 to 24, regular, and of the character described as existing after forty minutes.

For the next half hour she lay quiet and motionless on the side, breathing 20 tranquilly, and apparently sleeping, but raising the head and mewing when spoken to; the heart beating rapidly 240, but regularly.

After *two and a half hours* she was aroused by the most severe paroxysm she had had, lasting a minute, and arresting the breathing nearly the whole of the time. A little frothy mucus was expelled from the mouth. On recovery, the respiration was 16, quite regular and free, and continued so with good heaving of the chest and inflation of the lungs for the next half hour. During the first half of this time the action of the heart was very rapid and regular, except towards the end of expiration, when it uniformly intermitted. During the latter half of this time the respiration was full and thoracic, the lung sounds quite clear, and the pulse was regular throughout the respiratory act, but varied in frequency from 100 to 250. The diaphragmatic effects were now rare, but as often as they occurred the animal was aroused from a state of quietude; and twice, between the third and fourth hours, affected with a slight spasm. The respirations in this interval were 14 to 15, the inspirations full drawn, and the pulse 260, and regular.

After *four and a half hours* she was lying quietly on the stomach with the head resting on the floor—but raising it and mewing gently when spoken to, the respirations 22, regular and good, the pulse 140, also regular and of fair power—when she was suddenly seized with a succession of most violent, retching-like spasms, induced by inability to expire. The first was attended by the expulsion of a small spoonful of frothy mucus, the others with a little blood-stained froth. She had in all six such attacks, the first four coming on at intervals of a quarter of an hour, and the last two at intervals of an hour, and they gradually diminished in intensity. During this long interval a low moan accompanied each rather long expiration, and the inspiration was also prolonged, beginning by expansion of the chest and followed by the abdominal expansion, the action of the diaphragm being delayed.

At the end of this interval, *i. e. six and a half hours* after the injection of the aconitia, she was couching naturally, apparently dosing, but turning the head to the slightest noise and liking to be caressed. The respirations 60, regular, and fairly performed. The pulse at the rate of 100 during expiration, and of 160 during inspiration. The pupils unchanged. There was no more spasm nor apparent discomfort after this, and up to the tenth hour after the injection she remained in a quiet dozy condition, but disturbed by the least noise, and raising the head and looking up. The respirations regular and rapid, 130 (!); the lung sounds clear; the cardiac action regular and strong, the pulse being 150. She had neither taken food nor passed any excreta for eleven hours. She now met me at the door with tail erect, walked down-stairs, and manifested pleasure on seeing her feline relatives in the kitchen. In fact, she was quite recovered, and soon afterwards passed a large quantity of urine. Next morning she ate ravenously, and was quite well and lively.

The phenomena are not difficult to explain in this case. The earliest effect was intermittent spasm of the larynx, with intervals of dyspnœa. The spasm now and then reached a climax and suffocation impended; when the spasm had exhausted itself, a brief relief to the chest followed. Before the end of the second hour, either the expiratory muscles were in a state of continuous and partial cramp, or the muscles of inspiration were wearied and partially paralysed, for there was urgent dyspnœa, the diaphragm alone sustaining the inspiratory act, and its ineffectual efforts provoked great distress. This muscle, moreover, survived the influence which simultaneously cramped one set of the respiratory muscles and paralysed the others, and thus preserved the life of the animal. After the struggle was over, and the respiratory muscles were freed from the restraint, the respirations were increased out of all proportion to the pulse. The action of the heart throughout corresponded to the respiratory difficulty. This was most conclusively illustrated at every stage, but more particularly between the third and fourth, and the sixth and seventh hours. Locomotion was weakened, but the voluntary efforts were throughout very violent when excited by

the distress of spasm. Consciousness and common sensation were retained throughout, the former completely.

Obs. 7.—In this case, a young cat, weighing nearly three pounds, succumbed to the $\frac{1}{500}$ of a grain of aconitia, seven and a quarter hours after the subcutaneous injection of the poison.

No symptoms occurred until *half an hour* afterwards, when she was affected with a series of rapid spasmodic gulpings, attended with evident distress and a stiff, tottering gait, after which she sat quiet, apparently engaged with her own sensations.

After *forty-five minutes* the respirations were 80, hurried and irregular; the inspirations short and attended with an elevation of the nostrils, by which they were easily counted; when caressed she purred, but the purr was soon converted into a moist râle; she lay loosely on her belly with the hips and shoulders outspread and the tail laxly extended, and responded feebly when spoken to; the breathing became quiet during the next fifteen minutes, but irregular and 60; the femoral pulse 120.

After *an hour and a quarter* another but more severe choking spasm, the head being forcibly retracted, and the purple mouth violently opened as desperate attempts were made with a despairing cry to draw air into the chest. Then she lay on her side, inspiring with open mouth twenty-three times a minute, each inspiration followed by closure of the mouth and an audible gulping sound.

During the next hour she had five intense spasms, each announced by an open-mouthed cry, the protrusion of a purple tongue, and champing of tenacious frothy mucus; the respirations 26 to 16, for the most part regular—a laboured distressed inspiration, and short sudden expiration; the heart was beating strongly, about 90, with a slight occasional irregularity. There was some distress in the intervals due to spasmodic gulping, which often regularly alternated with the inspirations.

After *two and a half hours* the respirations were 16, of the same character; the femoral pulse full, hard, and regular, excepting at the moment of inspiration, when it was inclined

to intermit; the finger barely caught the weaker pulsations which indicated a momentary diminution of arterial pressure.

During the next hour she was free from the choking spasms, but the spasm of deglutition continued as before; the respirations were gradually reduced to 9, each shallow inspiration accompanied as before by opening of the mouth. The pulse varied from 60 to 80, and continued of good volume and power, a few accelerated beats occurring at the end of inspiration. The pupils were contracted to mere slits towards the dark side of the room. The crawling powers were feeble; the body became cold; she still answered me with a faint mew. The bowels acted involuntarily twice during the hour.

During the next three hours there were only two choking spasms and an attack of retching, in which she expelled very forcibly an ounce of fluid from the stomach; the respirations, 12 to 16, maintained the same character; the pulse varied from 96 to 76, was fairly regular, but weak; general feebleness increased, but she still purred when caressed.

After *seven and a quarter hours,* and a long and even tranquil interval of more than half an hour, the animal was seized with violent retching, attended at first with expulsion of a little frothy mucus; after three or four retchings, each ending in an agonising cry, and the expulsion of about four ounces of urine, she fell over on the side and the breathing ceased for long intervals, during which the contracted shoulders quivered with spasm and the paws were strongly flexed.

During the next three minutes there were three faint inspirations, and then the pupils dilated and the body became completely lax. The temperature of the rectum six inches within the body was at this time 92° Fahr.

Spasm of the gullet occurred simultaneously with spasm of the larynx in this case, as, no doubt, happened in the others, but was noticeable in this on account of the gulping noise; the inspiratory difficulty was soon declared by the orthopnœa and elevation of the nostrils. The third nerve evidently conveyed spasm between the second and third hours; and the contracted pupils from that time to the moment of death may have been taken as an index of the continuous state of cramp which affected the expiratory muscles. Consciousness was

completely retained throughout; the limbs seemed partially paralysed in the state of quietude, but during the spasm she was able to make strong efforts. The effect of inspiration on the pulse was also very marked in this case. The evacuations were doubtless due to spasmodic contraction of the circular fibres of the intestines (see Obs. 5, p. 10).

Obs. 8.—In the following case, that of a half-grown cat weighing three pounds, death occurred in three quarters of an hour after the subcutaneous injection of the $\frac{1}{300}$ of a grain of aconitia.

The symptoms came on after ten minutes with a stilted walk and evacuation of the bowels.

After *fifteen minutes* she was lying sprawling on the side or belly, the respirations 34, shallow, semi-stridulous, and accompanied by a low whine or moan. Between the twenty-fifth and thirtieth minutes she had a fit of struggling, turning over and over, scrambling about in an angry-looking way, lashing the tail, growling in a subdued tone, and occasionally pushing the paws over the sides of the mouth.

After *half an hour* she ejected a little piece of frothy mucus from the mouth. Respiration 18, forced. All the distress seemed to be caused by inability to inspire freely, the shoulders being tucked in, and the mouth opened at each inspiration. The mouth was occasionally opened wide, and a strong effort made to expire or to vomit as she turned from side to side in great distress.

After *forty minutes* another momentary struggle left the respirations varying during the next five minutes from 26 to 36; the inspirations short, snatchy, and ineffectual, each being accompanied by a depression of the lower jaw. The heart's action regular but weak, 140; the surface cold.

At the forty-fifth minute the respirations were suddenly interrupted by an interval of half a minute, two short inspirations followed, then an interval of forty seconds, ending in a faint inspiratory effort, the immediate and complete dilatation of the pupils from a state of complete contraction which had existed for the previous fifteen minutes, and flaccidity of the body. Consciousness was preserved to within a few minutes of death.

The chest was opened without injury to the veins two minutes afterwards; the right auricle and roots of the great veins pulsated regularly but feebly 72 times in the minute, and continued to do so for ten minutes. The right heart and vessels attached were greatly distended by dark blood. The left heart was contracted and contained a few drops of dark venous blood. The lungs were completely collapsed and of a dusky vermilion tint. The bladder was full, the intestines contracted, the stomach empty but flaccid, and the cardiac end of the œsophagus also flaccid.

Here the increased dose of poison produced a rapid succession of suffocative paroxysms caused by spasmodic closure of the glottis.

Obs. 9.—A female cat, two years old, was the subject of this experiment. One eighth of a grain of aconitia dissolved in ℥xv of spirit of wine, injected under the skin of the neck, caused death in twenty minutes.

After fifteen minutes she had vomited a little, and was now on her side curled forwards, the fore legs strongly incurved, the mouth widely opened and covered with mucus, gasping for breath and struggling frantically. After the spasm was over she walked a few yards with a tottering gait, and then fell over in another suffocative spasm; then there was a short intermission, during which I was able to notice the breathing. At one time I counted six laboured inspirations in a minute, becoming progressively slower until the last long interval was closed by another paroxysm and the final cessation of the breathing twenty minutes after the injection of the poison. In this last spasm urine was expelled. The pulsation of the heart was palpable for some seconds after the respiratory death. The pupils were fully dilated and the eyelids widely opened during the five minutes the spasms prevailed.

The chest was contracted, and the diaphragm firmly pulled up high into the chest cavity. The chest was opened three minutes after death. The lungs were collapsed behind the heart, of a dull rose colour, and retained but a trace of crepitation. The blood was collected on the right side of the heart and great vessels in connection with it and the roots of the lungs. The heart was quite still. The pulmonary veins con-

tained some dusky crimson blood, the left auricle was flaccid, the ventricle contracted. On cutting through the great veins, the right ventricle contracted completely, the auricle partially and remained flaccid. The blood was dark; it speedily coagulated, forming a firm clot. The œsophagus, stomach, intestines, and bladder were empty and contracted, but not firmly as in Obs. 4 and 5, pp. 8 and 10.

In this case the action of the drug was almost continuous during the five minutes which elapsed between the commencement of the symptoms and death. Exhaustion of the inspiratory muscles ensued before the whole of the blood had become completely venous. The object of removing the blood from the distended heart by cutting through the veins was to ascertain whether the ventricle had retained the power of active contraction. This complete depletion, of course, prevented the renewal of pulsation in either cavity.

On Man.—The subject of the following observations was a large but lethargic man, Charles W—, æt. 54, lamed by chronic sciatica. The pupils were a little unequal; at a given light the right was $\frac{1}{8}$, the left $\frac{1}{7}$. The pulse was 66, regular, of good volume and power; the respirations 16 to 17.

In order to test the value of the following observations, I watched the effect of complete rest of mind and body on the respiration and pulse during two and a half hours as he sat still without once rising from his seat.

After *an hour and a quarter* the pulse was 61, of initial volume and power, the respirations 16; there was slight somnolency.

After two and a half hours the pulse was 58, not changed appreciably in volume and power, and the respirations were 15; the pupils were unchanged.

Obs. 10.—The $\frac{1}{200}$ of a grain of aconitia, taken by the mouth at intervals of three days, always caused slight tingling in the mouth and face, coming on within an hour and lasting for two or three hours. On another occasion—

After the $\frac{1}{175}$ of a grain a faint glowing feeling in addition was perceptible throughout the body, and there was a little somnolency. On another occasion—

The $\frac{1}{150}$ of a grain converted the glowing feeling into a

numbing-glow—a comfortable feeling as if he were going off to sleep, and, if he did not move about, actual somnolency. These effects attained their maximum two hours after the dose; he felt warmer while they continued, and there was at the time and afterwards some difficulty in voiding urine.

Obs. 11.—The pulse being 66, and the respirations 17, he took the $\frac{1}{150}$ of a grain of aconitia, and did not rise from his chair for three hours.

After *forty minutes* the pulse was 60, unchanged; the respirations 17; somnolency was coming on.

After *an hour and a quarter* pulse 58, unchanged; respirations 16; pupils unchanged. He had slept for twenty minutes; a general glow pervaded the body.

After three hours pulse 56, unchanged, unaffected by deep inspirations; respirations 16, regular. The glow and somnolency continued, and he had dozed several times; the tongue and pupils were unchanged, and he felt comfortable throughout.

Obs. 12.—On another occasion, after sitting still for an hour and a half, at the end of which time the pulse was 60, the respirations 17 to 16, I gave him the $\frac{1}{100}$ of a grain of aconitia.

After *an hour and a quarter* the pulse was 54, unchanged in volume or power; the tongue and pupils unchanged.

After *three hours* pulse 52, of initial volume and power; the respirations 16, natural; the pupils very slightly dilated (?). He felt warm and dozed much after the medicine.

Obs. 13.—He took the $\frac{1}{50}$ of a grain repeatedly at intervals of three days at 9 a.m. The effects were uniform. The medicine "upset him very much all day; he felt languid and sleepy; he could not hold the head up or keep his eyes open." He was giddy and could not walk across the room without help; the vision was hazy; the erect posture induced nausea. He could not eat much on the medicine days on account of a difficulty of swallowing and a pain in the back of the neck and behind the jaws in the parotid region, so that in eating he had to press the back of the neck with his hand. A glowing,

tingling feeling pervaded the body, and there was a burning feeling in the gullet, "as if a hot coal were there."

The tingling in the mouth and face came on within half an hour, the somnolency after one and a half or two hours. At first he slept for an hour, but afterwards the sleep was dreamy and broken. The giddiness, dimness of vision, and the muscular weakness were most marked between the sixth and tenth hours. There was always some dysuria, and occasionally retention with hypogastric pain.

Nausea was generally a prominent symptom, and the pain in the neck often remained until the next day.

I kept him under observation for three hours after one dose, but could detect no appreciable effect on either the pulse, pupils, or breathing. At the end of this time the pulse was 60, regular, of good volume and power, a trifle more compressible, perhaps, than before the dose; but this will always be found the case after a long rest of mind and body and with a tendency to sleep. The respirations 17, regular and easy; the tongue and pupils unchanged.

These observations were repeated on two other adult males with uniform results. Doses ranging from the $\frac{1}{75}$ to $\frac{1}{50}$ of a grain of aconitia always produced decided aconitism—general numbness and tingling, but most marked in the face and throat; nausea giddiness, somnolency, and muscular weakness. This latter is always a prominent effect, and it strongly resembles the condition induced by hemlock.

Obs. 14.—Frederick G—, æt. 12, a well-developed boy, afflicted with epilepsy, the $\frac{1}{100}$ of a grain of aconitia given repeatedly at intervals of three days produced the following effects:

After *three quarters of an hour* a tingling pricking sensation running up the legs to the spine and head, and tingling of the fingers, much giddiness and somnolency, but the sleep was disturbed by frequent awakings.

After *two hours* he was unable to walk or even stand without great exertion, and on rising from the recumbent posture he was unable to see for a minute, and there was nausea. The effects lasted for seven or eight hours, after which he slept comfortably, and felt quite well the next day. I was unable

to discover any influence on the breathing, pulse, pupils, or tongue, nor was there any diminution of temperature.

This observation was repeated with uniform results on another young patient, Samuel H—, æt. 9.

The Subcutaneous Use of Aconitia in Man.—The following is the solution which I have employed:

Aconitia, 1 grain;
Acetic acid, 1 minim;
Rectified spirit, 2 fluid drachms;
Water sufficient to make the mixture measure 2000 grain measures.
Dissolve. $5\frac{1}{2}$ minims (= 5 grain measures) = $\frac{1}{400}$ of a grain of aconitia.

This solution will keep unchanged for years; a drop of a solution prepared four years ago placed on my tongue to-day produced numbing and tingling of my palate for five hours afterwards. I have used this in doses varying from the $\frac{1}{1000}$ of a grain (= $\frac{1}{250}$ by the mouth) to the $\frac{1}{200}$ of a grain (= $\frac{1}{50}$ by the mouth).

The $\frac{1}{1000}$ of a grain rarely produced appreciable effects; the $\frac{1}{200}$ caused effects equal in intensity to the $\frac{1}{50}$ of a grain when given by the mouth. Beyond this dose I have not thought it safe to go.[1] The injection always produced considerable local burning, pricking, and smarting, but never inflammatory action. I have employed it in cases of spasm of the voluntary muscles and in sciatica, but without benefit, and I have come to the conclusion that the alkaloid is unfit for subcutaneous use.

Conclusions.—Excepting those on the horse,[2] the foregoing observations, which have been made at long intervals during

[1] In the report of the committee on the hypodermic mode of injection, 'Med.-Chir. Trans.,' vol. 1, p. 584, it is stated that the $\frac{1}{100}$ of a grain was injected beneath the skin. In the "Appendix," p. 631, giving details of the experiments, nothing is said of this case, nor are any effects mentioned as resulting in the two other cases in which the $\frac{1}{320}$ and the $\frac{1}{210}$ of a grain respectively were used. Now, since the $\frac{1}{24}$ of a grain very nearly killed a horse (see Obs. 3), the $\frac{1}{100}$ of a grain would most surely cause very severe effects, if not death, when given by subcutaneous injection to man. I assume, therefore, that the aconitia used in this case was "the far less active sample" referred to, p. 567.

[2] I would here express my obligations to my friend Mr. Frederick Mavor, of Park Street, for placing these animals at my disposal and for aiding me in my experiments on them.

the last seven years, have never yet been associated in my memory, and I have now for the first time brought them together in the words in which they were recorded.

As mere observations of all the phenomena that presented themselves, they were noted without regard to any theory or preconceived idea of the action of the plant. Upon examination they will be found to present the most complete uniformity. To my mind the phenomena which are detailed are intelligible enough, and when brought under our view will serve to clear up the vagueness aud uncertainty which have hitherto surrounded the subject.

In a brief review of each case I have indicated the cause and sequence of the phenomena therein presented, and I shall, therefore, content myself with the following summary :

1. Aconite affects a portion of the cranio-spinal axis in the same manner that strychnia affects the whole. It produces an excitation which results in intermittent spasm.

2. The focus of the action of aconite is the medulla about the roots of the pneumogastric, hypoglossal, and spinal accessory nerves. Thence its influence radiates along the cranio-spinal axis with rapidly diminishing intensity, as far forwards as the centres of the third nerve, and as far downwards as the origin of the phrenic. The centres about the focus of action are more or less in a state of constant excitation, while those towards the limits are sometimes in a state of depression and sometimes in one of excitation; thus, for example, during a spasm the pupils may be completely contracted, but in the intervals, and always after moderate doses, they may be slightly dilated, or, at least, the muscular apparatus engaged in accommodation is so far enfeebled that dimness of sight and giddiness result as after conium. And so also with the diaphragm ; it is enfeebled by small doses, and is alternately affected by spasm and exhaustion after large ones. Occasionally, however, and during the more violent suffocative spasms, the muscles of the whole of the anterior part of the body, including the anterior extremities, are involved in the attack (see Obs. 3, p. 4, and Obs. 7, p. 15).

3. Beyond the limits above indicated aconite exercises a depressing influence on the cranio-spinal axis, almost amounting to paralysis.

4. The action of the alkaloid on the sensory function appears to be coextensive and coequal with that on the motor function, the area for intense action having the same limits, beyond which the anæsthesiant action rapidly diminishes in intensity. Thus, while the head and neck are deprived of sensation, the rest of the surface is only partially affected, and the sensibility of the lower parts of the body only slightly or not at all disordered.

5. Apart from the derangement of accommodation, from spasm or enfeeblement of the muscular apparatus of the eye and the ear, the senses of sight and hearing were unaffected; the latter, indeed, was *apparently* wholly unaffected. There was no evidence of any impairment of smell. Taste was, without doubt, greatly disturbed, both on account of its relation to common sensation, and of the deep implication of the fifth nerve.

6. Beyond the slight depression of function resulting in somnolency (after medicinal doses and in the intervals of the paroxysms which follow poisonous ones) aconite has no direct influence on the brain, and the effects produced by asphyxia have usually only a brief duration at the end of a paroxysm or immediately preceding the death of the animal. The intense distress of impending suffocation produces, however, a total disregard for everything else but the desire for relief, and thus the animal rages frantically about as if actually delirious.

7. The sympathetic nerve is unaffected. At the moment of death the pupils dilate vigorously; and after death the heart may continue to pulsate,[1] or, if the right heart be arrested by distension, its action may be revived by depletion. The contracted left heart is still, only because it is empty.

From the evidence adduced, it is I think, conclusively proven that the heart is only secondarily affected, and as a consequence of the respiratory difficulty. If I could scandalise common sense by belief in the idea that the heart was under an inhibitory influence conveyed to it by the cardiac branches of the pneumogastric, I might argue that the foregoing observations go very far to disprove the existence of such a function, unless I could persuade myself that the cardiac branches of the

[1] This I find is strictly in accordance with Dr. Fleming's observations: 'Inquiry into the Physiological and Medical Properties of Aconite,' p. 91, et seq.

vagi were paralysed and incapable of conveying an inhibitory influence at the time when the other branches of the nerve were conveying violent excitations—a supposition as preposterous as that of nervous inhibition itself. The cardiac branches of the pneumogastric are the means simply of connecting the heart with the cerebro-spinal system, and regarded as such, the only question is to what extent they embarrass the heart by any cramping influence which they may convey during the action of aconite. It is not evident that they convey any such influence, but if they did it could at most be but slight. The cardiac action, as we have seen, is greatly interfered with during the action of the alkaloid, and an attentive study of the foregoing Observations, especially 3, p. 5, and 6, p. 14, will clearly show that the whole of this interference is the result of the impeded respiration, of the suffocative spasms, and of the brief relief which the localised spinal exhaustion brings to the heart. The following observation will render the cardiac phenomena in the preceding cases still more clear.

Obs. 14.—Alfred L—, æt. 21, had formerly smoked to excess, but was in good health, his ailments being due to nervousness and a naturally (?) feeble cardiac action. After a walk of three miles and a short rest the pulse was 76, of good volume and fair power; the respirations 18. He now took the $\frac{1}{150}$ of a grain of aconitia and remained dozing in a chair by my side without once rising until the following observations were completed. The more general effects of the alkaloid were slight.

An hour after the dose the pulse was 58, regular, and slightly increased in volume and strength; respirations 16. He had dozed several times.

After *two hours* the pulse was 48, otherwise unchanged; the respirations 15.

Near the end of the *third hour* the pulse had fallen to 44, and was of initial volume and power; the respirations 14, with diminished movement. He had dozed several times. On causing him now to take eighteen deep forcible inspirations in the minute for several minutes, the pulse was gradually and uniformly accelerated and numbered during the first minute 56, during the fourth 62, and during the seventh 65. The breath-

ing was now allowed to resume its spontaneous tranquillity, and during the ninth minute the pulse numbered only 45, but as the heart had not quite adapted itself to the change, one or two beats were weaker than the rest. This little irregularity of power, however, disappeared in the course of the next minute, when the pulse resumed an uniform rate of 45, equal pulsations, and preserved it. On now causing him to expire forcibly and hold the breath for fifteen seconds the pulse rose to 59, and fell next minute with normal breathing to 48, and then to 45, which it maintained with perfect regularity. After an interval the last observation was repeated, and then it was ascertained that the acceleration took place during the latter half of the time, and that the ratio rapidly increased until the urgent call for air was obeyed. The acceleration amounted to 8 beats during the one eighth of a minute, equal to 64 for the whole minute. But if air had been prevented entrance to the chest for so long a time as a minute it is probable that the acceleration having reached its maximum very rapidly would then on account of excessive pressure on the right heart have declined, to be advanced again the moment the cardiac distension was relieved by an efficient inspiration or two.

Thus it is that a depression of the respiratory function causes at first a depression or sleepy condition (for sleep may in certain conditions be observed to have the same influence on the respiration and pulse as that I have just described) of the cardiac action. Then, and much more so when the respiratory difficulty is increased, the act of inspiration is followed by acceleration, and it is thus that both temporary suspension of the inspiratory action and its restoration combine to produce the acceleration of pulse in aconitia poisoning which accompanies the suffocative paroxysm, but which only attains its maximum directly after this is over.

It is further to be observed that the pulse rapidly fails towards the end of the paroxysm, and if the animal fall flaccid after this is over it would appear that death had resulted from syncope. Such, however, is not the case, as the facts above given and a little reflection will prove. After death the left heart is found empty and the lungs collapsed. If collapse had occurred only at the moment of death—death from syncope—the left cavities would have been full, for the blood would

naturally pass in this direction, and not, of course, towards the engorged right heart. Nor, on the other hand, can death be due to spasm of the heart—of the left heart—for let us consider what would occur in such a case. The left ventricle and cavity are spasmodically closed, the right heart we know is engorged, the lungs are anæmic, and suffocation impends; the last act of life under such circumstances would be to suck the right heart empty and allow its cavity to contract, spasmodically on this theory also; and we should find the lungs expanded and the great veins collapsed. But it has been shown that these conditions do not exist.

Why then does the pulse intermit and fail under the finger during the suffocative paroxysm? Obviously *not from want of power* in the left ventricle, *but from want of blood;* it is really emptied during the paroxysm.

8. Death results from asphyxia and progressive collapse of the lung, the former being due to the spasmodic closure of the respiratory passages and paralysis of the muscles of inspiration, and the latter to paralysis of the muscles of inspiration and notably of the diaphragm, which is tucked up higher and higher by the intermittent efforts of the upper intercostals, the scaleni, and sterno-mastoid muscles.

If, however, the heart be weakened by disease it may be unable to sustain the strain imposed by obstructed inspiration, and death would then result from syncope, and thus the terrible battle would be sooner ended.

An examination of the published cases[1] of poisoning by aconite will, I believe, show that the action of the poison is uniform and strictly in accordance with the foregoing facts and explanations.

I now come to the second part of my task—the influence of aconite on the febrile state. I give the following cases in the

[1] The following references may be consulted:—'Phil. Trans.,' vol. xxxvii, p. 287; a case by Mr. Sherwin, 'Lancet,' 1837, March 25th; Pereira, vol. ii, pt. ii, p. 687; and a particularly instructive case by Drs. W. H. Thompson and W. Cayley, 'Brit. Med. Journ.,' November, 1872, p. 579.

order in which they occur in my note-books, only placing the different fevers in separate categories and associating similar doses. I might have extended this part of my paper, but I find that the remaining cases differ in no essential particular from those adduced. The following is the formula of the mixture used :

Aconitia, 1 grain;
Rectified spirit, 6 fluid ounces;
Camphor water, to measure 5 pints (100 fluid ounces); mix.
F. ℥ss = $\frac{1}{200}$ of a grain of aconitia.

The aconitia was always given in a single dose, and once only, excepting in a few cases, in the twenty-four hours. In a few other cases a dose was given on alternate days only. It is evident from the foregoing Observations that the doses given were efficient ones, and that their effects extended usually over from eight to twelve hours. Indeed, I soon found that nausea and vomiting, often followed by diarrhœa and partial collapse, occurred when the dose was given twice in the twenty-four hours.

Obs. 15.—Harriett S—, æt. 13, admitted on the 3rd day of a moderate attack of scarlatina. She took the $\frac{1}{800}$ of a grain of aconitia once daily from the 3rd to the 9th day inclusively.

3rd day, before the aconitia.—	Pulse 120.	Rash vivid.
4th „ after „	„	120.	Rash bright, pimply, serous on the arms, from profuse sweating.
6th „ „ „	„	104.	Conjunctiva injected. Rash fading.
7th „ „ „	„	96.	To have fish.
9th „ „ „	„	60.	Active desquamation.

She took a full diet on the 10th day, and left the hospital well on the 25th day.

Obs. 16.—Sarah B—, æt. 6, admitted on the 6th day of a moderate attack of scarlatina. Took the $\frac{1}{800}$ of a grain of aconitia once daily from the 7th to the 19th day inclusively.

7th day.—	Pulse 108.	Rash well developed; glands of the neck swollen and knotty.
9th „	„ 96.	Rash was vivid; retching this morning; rhinorrhœa; cervical glands hard.

12th day.—Pulse 100. Tongue moist and clean.
16th „ „ 88. Skin cool; glandular swelling decreasing.
19th „ „ 84. Skin cool; general desquamation; glandular swelling subsiding; hunger.

She took full diet the next day. Left bed on the 30th day and the hospital on the 44th, after a renewal of the glandular swelling.

Obs. 17.—Jane B—, æt. 7, the sister of the above, admitted on the 5th day of a moderate attack of scarlatina. She took $\frac{1}{800}$ of a grain of aconitia twice a day from the 5th to the 14th day inclusively. The pulse on admission was 124, and it gradually subsided, being 100 on the 7th day, 84 on the 10th, and with the temperature normal on the 14th. She left bed on the 28th day and the hospital on the 40th day.

Obs. 18.—Alfred T—, æt. 11, admitted on the 2nd day of an attack of scarlatina. He took $\frac{1}{400}$ of a grain of aconitia every other morning from the 3rd to the 9th day inclusively.

2nd day, no aconitia.—Pulse 128. Rash vivid.
3rd „ after „ „ 132.
4th „ no „ „ 128. Rash still very vivid.
6th „ „ „ „ 116. Saline aperient.
8th „ „ „ „ 108. General desquamation.

Convalescence proceeded without interruption. He took full diet on the 14th day, left bed on the 20th, and the hospital on the 35th day.

In this case the aconitia did not repress the rising fever.

Obs. 19.—Samuel D—, æt. 10, admitted on the 2nd day of an attack of scarlatina. He took the $\frac{1}{400}$ of a grain of aconitia every alternate morning from the 2nd to the 9th day inclusively.

2nd day, before the aconitia.—Pulse 128; weak.
3rd „ after „ „ 132.
4th „ no „ „ 124.
5th „ after „ „ 120; good volume and power.
6th „ no „ „ 96.

Convalescence began the following day, and continued with

slight interruption from glandular swelling in the neck. He left bed on the 29th day and the hospital on the 35th.

Obs. 20.—Charlotte C—, æt. 9, admitted on the 5th day of moderate attack of scarlatina. She took the $\frac{1}{400}$ of a grain of aconitia from the 5th to the 10th day inclusively.

5th day, before aconitia.—				Pulse 100.	Temperature 103°.	
6th	„	after	„	„ 100.	„	102·7°.
7th	„	„	„	„ 60.	„	99°. Desquamation.

On the 9th day she took fish; and on the 11th the aconitia was omitted and she took full diet, and went out well after an attack of variola.

Obs. 21.—Amelia H—, æt. 14, admitted on the 2nd day of moderate attack of scarlatina. Took $\frac{1}{400}$ of a grain of aconitia once daily from the 2nd to the 11th day inclusively.

2nd day, before the aconitia.—			Pulse 120.	
4th	„	„	„ 116,	of good power; profuse perspiration. Rash vivid.
5th	„		„ 108.	Surface of chest and abdomen and neck rough with sudamina, which, being filled with milky serum, resembled miliary pustules.
8th	„	„	„ 64.	General and active desquamation; tongue moist and clean; hunger.
11th	„	„	„ 64.	Feeling well.

She took full diet on the 12th day. Subsequently (a week later) she had a relapse with aural discharge and swelling of the tonsils, but she left the hospital well on the 32nd day.

Obs. 22.—Charles K—, æt. 9, admitted on the 3rd day of an attack of scarlatina. He took $\frac{1}{400}$ of a grain of aconitia twice daily from the 4th to the 13th day inclusively.

4th day, before the aconitia.—				Pulse 116.	Pupils ¼.
5th	„	after	„	„ 100.	Pupils ⅓.
8th	„	„	„	„ 100.	Rash nearly faded; began to convalesce.
10th	„	„	„	„ 68.	Pupils ⅓; skin cool; tongue moist and clean. Fish.
12th	„	„	„	„ 89.	Pupils ⅓; appetite good; desquamation.

Next day he ate full diet. On the 20th day the pulse was 64, and the skin was desquamating actively.

Obs. 23.—William L—, æt. 13, admitted on the 2nd day of a slight attack of scarlatina. He took the $\frac{1}{400}$ of a grain of aconitia every alternate morning from the 3rd to the 9th day inclusively.

2nd day,	before the aconitia.	—Pulse 84.	Rash developed.
3rd „	after „	„ 112.	
4th „	no aconitia	„ 92.	
6th „	„	„ 80.	Skin cool; rash faded.
8th „	„	„ 72.	Desquamation beginning.
9th „	before and after „	„ 65.	

He took full diet the following day, and rapidly convalesced.

Obs. 24.—George B—, æt. 13, admitted on the 2nd day of a severe attack of scarlatina. He took the $\frac{1}{300}$ of a grain of aconitia every other morning from the 3rd to the 16th day inclusively.

2nd day,	before the aconitia.	—Pulse 128.	Rash vivid; had vomited; cervical glands swollen.
4th „	aconitia the previous day.	—128.	Tongue dry; bowels freely open; rash vivid.
5th „	„ to-day	104.	Much improved.
6th „	no „ „	92.	Tongue dry in the centre.
8th „	„ „ „	96.	

He continued to improve; the glandular swellings subsided. On the 15th day the pulse was 84, and there was abundant desquamation. He left the hospital well on the 25th day.

Obs. 25.—Eliza M. K—, æt. 24, admitted on the 4th day of a slight attack of scarlatina. Took the $\frac{1}{400}$ of a grain of aconitia once every alternate day from the 4th to the 10th inclusively.

4th day,	before the aconitia.	—Pulse 110.	Rash developed.
6th „	after „	„ 60.	Skin cool; rash still present; hunger.

The pulse continued 60. On the 8th day she felt quite well, and the rash was nearly faded. On the 14th day there was a

slight relapse, with swelling of the right tonsil. She left bed on the 22nd day and the hospital on the 31st.

Obs. 26.—Arthur M—, æt. 15, admitted on the 3rd day of an attack of scarlatina. Took $\frac{1}{200}$ of a grain of aconitia once daily from the 3rd to the 10th day inclusively.

3rd day,	no aconitia.—	Pulse	124.	Rash vivid; throat moderately affected.
4th „	aconitia	„	108.	Temperature high; rash very vivid.
6th „	„	„	84.	Rash fading; throat not sore.
10th „	„	„	60.	Active desquamation; hunger.

Left bed on the 20th day and was discharged well on the 21st day.

Obs. 27.—Elizabeth B—, æt. 15, admitted on the 4th day of a moderate attack of scarlatina. Took $\frac{1}{200}$ of a grain of aconitia once from the 5th to the 10th day inclusively.

4th day,	before taking aconitia	the pulse was	116.	Temperature 102°; rash vivid.
5th „	after	„	110.	
10th „	„	„	60.	Temperature normal; desquamating actively.

Left bed on the 21st day and the hospital on the 27th.

Obs. 28.—Elizabeth J. M—, æt. 24, admitted on the 3rd day of a rather severe attack of scarlatina, which commenced with sickness. Took $\frac{1}{200}$ of a grain of aconitia once daily from the 3rd to the 5th day inclusive.

3rd day,	before the aconitia.—	Pulse	124.	
4th „	after	„	124.	Was perspiring; vomited both before and after the aconitia.
5th „	„	„	116.	Vomiting continued, four times to-day, watery fluid and mucus; the pulse became small, and there was prostration.
6th „	no aconitia	„	116.	Stronger and better; no more vomiting.

A week afterwards she was convalescent and taking full diet.

Obs. 29.—James B—, æt. 17, admitted on the 3rd day of mild attack of scarlatina. Took $\frac{1}{100}$ of a grain of aconitia

every alternate morning from the 3rd to the 19th day inclusively.

3rd day, before the aconitia.—Pulse 100. Rash fading.
5th „ after „ „ 88, of good volume and power.
19th „ no „ „ 60. Temperature normal; rash gone, active desquamation, and felt quite well.

On the 21st he took full diet, and left the hospital well on the 36th day. A dose of castor oil was required on the 4th day, after that the bowels acted regularly.

On looking over these cases I fail to see that the aconitia has exercised any appreciable influence on the course of the fever. When the drug was given before the fever reached its height, as in Obs. 18, 23, and 24, the pulse rose, and subsequently declined from day to day in the usual manner; and on comparing these cases with others of similar severity, and treated by other drugs, there is no marked difference observable. The cases were, for the most part, of moderate severity. All did well, and escaped any serious complications. Variola was prevalent in the wards when some of these cases were inmates, and two or three contracted variola in a mild form. It is to be observed that there was profuse perspiration in two (Obs. 15 and 21) on the 4th day.

All the remaining observations, except the last, are upon cases of typhus—a disease in which, owing to the great prostration and the tendency to pulmonary congestion, the action of aconitia might be expected to be prominently displayed.

Obs. 30.—Florence F—, æt. 11, admitted on the 7th day of an attack of typhus. Took $\frac{1}{400}$ of a grain of aconitia once daily from the 8th to the 10th day inclusively, and the $\frac{1}{300}$ of a grain every alternate day from the 12th to the 18th, having a dose on each of these days.

7th day, no aconitia.—Pulse 128. Rash copious, measly; slight injection of the conjunctiva.
9th „ after „ „ 124, of good power. Rash bright.
10th „ „ „ „ 128, weaker.
12th „ „ „ „ 116, good.

13th day,	no aconitia.—		Pulse 104, good.	Rash fading; some diarrhœa in the afternoon; no sickness.
14th „	after „	„	88, of good power.	Bowels still a little loose.
15th „	no „	„	84.	Skin cool; bowels quiet.
16th „	after „	„	88.	Skin warmer; tongue moist.
18th „	„ „	„	60.	Cool; takes fish.
19th „	no „	„	96.	

She took full diet on the 21st day. Left bed on the 25th and the hospital on the 34th.

Obs. 31.—Catherine C—, æt. 12, admitted on the 4th day of a severe attack of typhus. She took the $\frac{1}{400}$ of a grain of aconitia once every other day from the 5th to the 15th day inclusively.

4th day,	before the aconitia.—		Pulse 128.	Rash copious.
5th „	no aconitia	„	124, weak.	
8th „	„	„	124, of fair power.	
10th „	„	„	116.	Vomited this morning; bowels not relaxed.
11th „	after aconitia	„	116.	No vomiting since yesterday morning.
13th „	„	„	60, good.	Skin cool; no sickness nor diarrhœa.
15th „	„	„	60, good.	To have fish.

She left bed on the 19th day and the hospital on the 25th.

Obs. 32.—Annie H—, æt. 11, admitted on the 4th day of a mild attack of typhus, and took $\frac{1}{400}$ of a grain of aconitia every other day from the 4th to the 13th day inclusively.

4th day,	before the aconitia.—		Pulse 116.	
„ „	after „	„	108.	
6th „	„ „	„	120.	Tongue dry.
11th „	no „	„	104.	Rash still present.

On the 13th day she was feeling well, and took fish; two days later full diet, and left her bed on the 20th day.

Obs. 33.—Deborah Q—, æt. 11, admitted on the 4th day of slight attack of typhus. She took the $\frac{1}{400}$ of a grain of aconitia once every alternate day, from the 6th to the 10th inclusively.

4th day, no aconitia.—Pulse 100, good.
5th „ „ „ „ „ „
6th „ after „ „ 116.
7th „ no „ „ 108.
8th „ after „ „ 92. The rash nearly faded.
10th „ „ „ „ 88. Temperature normal. Tongue moist.

She took fish next day. On the 12th day she became deeply flushed. Pulse 100; temp. 102°, and the physical signs of congestion of the base of the right lung. The affection became more general. She recovered under the usual treatment, and left her bed on the 21st day, and the hospital on the 24th.

Obs. 34.—Frederick R—, æt. 16 (brother of William R—, see Obs. 38), admitted on the 6th day of a mild attack of typhus. Took $\frac{1}{200}$ of a grain of aconitia once daily from the 8th to the 17th day inclusively.

6th day, no aconitia.—Pulse 116, good.
7th „ „ „ „
8th „ after „ „ 84. Rash still present.
11th to 15th day, after aconitia.—Pulse 72. Temperature 103°. Sordes; injection of conjunctiva.
16th and 17th „ „ „ 65. Temperature normal.

The pulse was of good volume and power throughout. He ate fish on the 16th day, full diet on the 18th, left bed on the 23rd, and the hospital on the 31st. The pupils measured $\frac{1}{3}''$ from the 11th day onwards.

Obs. 35.—George R—, æt. 12, brother of the preceding patient, admitted on the 6th day of an attack of typhus. He took $\frac{1}{200}$ of a grain of aconitia once daily, from the 7th to the 18th day inclusively.

6th day, before the aconitia.—Pulse 120. Some stupor; rash present; tongue moist.
7th „ after „ „ 110.
8th „ „ „ „ 88.
11th „ „ „ „ 68. Rash gone. Temperature undiminished. Tongue parched.
12th „ „ „ „ 52.
15th „ „ „ „ 68. Temperature undiminished. Tongue moist.
17th and 18th day after aconitia „ 88. Took fish.

From this time the temperature declined, and convalescence was rapid. The pupils ranged from $\frac{1}{4}$ to $\frac{1}{3}''$, from the 11th to the 18th day.

Obs. 36.—John E—, æt. 28, admitted on the 8th day of a severe attack of typhus. He took the $\frac{1}{200}$ of a grain of aconitia twice daily, from the 8th to the 16th day inclusively.

8th	day	before	the aconitia.—	Pulse 124. Rash present; mind obscure; tongue moist.
9th	„	after	„	„ 120. Weak. Ordered ℥vj whiskey.
10th	„	„	„	„ 84. Delirium.
11th	„	„	„	„ 60, weak. Rash present; tongue dry; deglutition impaired; prostration. Temperature 103°.
12th	„	„	„	„ 84, small. Profuse sweating; stupor.
13th	„	„	„	„ 60, good. Skin moist; expression improved.
14th	„	„	„	„ 60, of fair power.
15th	„	„	„	„ 84, small and compressible. Body cool, mind clear, hands tremulous, and an exhausted look.

Two days after the omission of the aconitia, the pulse was 88, of fair volume and power; he took fish. A large bedsore formed over the buttock; but he gradually improved, and left the hospital well on the 75th day.

The pupils were contracted on the 9th day, but subsequently moderately dilated.

Obs. 37.—Ernest R—, æt. 14, admitted on the 7th day of a moderate attack of typhus. He took the $\frac{1}{200}$ of a grain of aconitia once daily from the 8th to the 21st day inclusively.

7th	day,	before	the aconitia.—	Pulse 124. Tongue dry; sordes; mind dull.
8th and 9th	days,	after	the aconitia.—	Pulse 100—68. Tongue dry and brown; rash still present.
11th	day,	after	the aconitia.—	Pulse 100.
12th	„	„	„	72, regular, of good volume. Aspect natural; hunger.
14th	„	„	„	60, of moderate volume and power. Temperature normal.
16th	„	„	„	60, of good volume, after deep, forced inspiration for half a minute, 80. Tongue moistening.
18th	„	„	„	60. Tongue still parched in centre.
21st	„	„	„	88, of good volume and power. Temperature 101°. Ate fish.

In the afternoon of the same day the tongue was moist and the temperature normal. He left bed a few days afterwards, and went out of the hospital on the 31st day. The pupils varied from $\frac{1}{8}$ to $\frac{1}{6}$ during the attack, on the 21st day they were $\frac{1}{4}$.

Obs. 38.—William R—, æt. 19, admitted on the 7th day of a moderate attack of typhus. He took the $\frac{1}{200}$ of a grain of aconitia twice daily, from the 8th to the 19th day inclusively.

7th and 8th days, before the aconitia.—Pulse 104.					
9th day, after the aconitia.—Pulse 100. Tongue dry; rash fading.					
10th	„	„	„	„	100, of good volume, easily compressed. Temperature 101°. Pupils $\frac{1}{4}''$.
12th	„	„	„	„	92. Pulpils in sunlight, as he slept, $\frac{1}{7}''$.
14th	„	„	„	„	64. Temperature 100°. Tongue dry and glazed. Pupils $\frac{1}{4}''$.
16th	„	„	„	„	64. Sordes; apathy. Wine, six ounces.
19th	„	„	„	„	88. Was more lively; tongue clean and moist. Hunger.

He took full diet on the 22nd day, when he left bed, and went out of the hospital on the 30th day.

Obs. 39.—Christopher McC—, æt. 15, admitted on the 5th day of an attack of typhus. He took $\frac{1}{100}$ of a grain of aconitia once daily, from the 5th to the 14th day inclusively.

5th day, before the aconitia.—Pulse weak, 120. Tongue dry; conjunctiva injected. Six ounces of wine.					
6th	„	after	„	„	68. Vomiting during the preceding night; skin moist.
7th	„	„	„	„	80, of good volume and power. Pupils $\frac{1}{4}''$. Mind clear.
10th	„	„	„	„	116. Pupils $\frac{1}{4}''$.
11th	„	„	„	„	110. Hunger.
14th	„	„	„	„	68. Tongue moist. To have fish.

He took full diet on the 18th day, left bed on the 20th, and the hospital on the 26th day.

Obs. 40.—James S—, æt. 17, admitted on the 4th day of an attack of typhus. He took the $\frac{1}{200}$ of a grain of aconitia once daily, from the 5th to the 14th day inclusively.

5th day,	before	the aconitia.	—Pulse 120,	weak. Tongue dry; the mind clear.
7th „	after	„	„ 64.	Skin warm; slight delirium.
8th „	„	„	„ 75.	A little cough and nausea. Pupils $\frac{1}{3}''$.
10th „	„	„	„ 100,	of fair volume and power. Temperature 100°. Pupils $\frac{1}{8}''$. Hunger.
12th „	„	„	„ 88,	good. Pupils $\frac{1}{3}''$. Tongue dry and brown at the centre; thirst.

Three days afterwards he took full diet, left his bed on the 19th day, and the hospital on the 27th.

Obs. 41.—Rosina S—, æt. 22, admitted on the 7th day of an attack of typhus. Took $\frac{1}{200}$ of a grain of aconitia twice a day from the 7th to the 11th inclusive, and from the 14th to the 16th inclusive.

7th day,	no	aconitia.	—Pulse 124.	
8th „		aconitia	„ 108.	Headache—the head felt "so big." General pains in the limbs.
10th „		„	„ 100.	
11th „		„	„ 88.	Rash still present; tongue dry and red; conjunctiva injected.
13th „		„	„ 72.	Rash fading; tongue moist and clean.
19th „		„	„ 56.	Respiration 28. Hunger. Full diet.

During the afternoon of the 14th day she had repeated and copious vomiting. It was attributed to the aconite, and this was omitted. Vomiting recurred in the evening of 16th, and was evidently due to the same cause. She left the hospital well on the 28th day.

Obs. 42.—Mary A. S—, æt. 38, admitted on the 4th day of a moderate attack of typhus. Took $\frac{1}{200}$ of a grain of aconitia twice a day, from the 5th to the 9th day inclusively.

4th day,	no	aconitia.	—Pulse 96.	Respiration 24. Temperature 103·2°.
7th „		aconitia	„ 80,	very small. Vomited a little green fluid.
9th „		„	„ 84.	
10th „		„	„ 116.	Temperature 103°. Mucous râles in the chest.
13th „		„	„ 100.	Tongue dry; a dull, heavy look.
16th „		„	„ 68.	Tongue cleaning; appetite returning.

A small parotid swelling appeared on the 19th day, but it

quickly subsided. She left bed on the 34th day, and the hospital on the 40th.

Obs. 43.—Mary A. C—, æt. 13, admitted on the 7th day of a moderate attack of typhus. Took $\frac{1}{200}$ of a grain of aconitia once daily, from the 8th to the 14th day inclusively. On the 7th day the pulse was 124, the rash copious, the tongue moist. The fever had subsided without any untoward symptoms by the 14th, when there was hunger. She left bed on the 22nd day, and the hospital on the 26th.

Obs. 44.—Amelia D—, very fat, æt. 28, admitted on the 7th day of a rather severe attack of typhus. Took $\frac{1}{200}$ of a grain of aconitia once daily, from the 7th to the 11th day inclusively, and the $\frac{1}{400}$ of a grain from the 12th to the 13th inclusively.

7th	day,	before the aconitia.	—	Pulse 124, soft.
8th	„	after	„	„ 120, soft.
9th	„	„	„	„ 108.
10th	„	„	„	„ 100, weak.

An hour after the aconitia was taken on the 10th day she was attacked with diarrhœa and vomiting, followed by pallor and collapse. She recovered under the influence of brandy, but continued very prostrate. On the 13th day there was subsultus and picking of the bedclothes, and much sordes. Pulse 100. She took 12 ounces of brandy daily, and gradually improved; and, on the 16th day, the pulse was 104, of good volume and fair power, the tongue moist and clean. She left bed on the 31st day, and the hospital on the 36th.

Obs. 45.—Catherine G—, æt. 14, admitted on the 4th day of a severe attack of typhus. She took $\frac{1}{200}$ of a grain of aconitia every other morning, from the 6th to the 18th day inclusively.

		Pulse.	Temp.	
4th	day, no aconitia.	124	—	
5th	„ „ .	124	103·8°.	
6th	„ after aconitia	116, weak.	103·4.	Rash vivid; tongue moist.
7th	„ no „	116	103·8.	
8th	„ after „	120, good.	103·8.	Rash copious and bright; tongue dryish.
9th	„ no „	124	104·4.	

		Pulse.	Temp.	
10th day, after aconitia	.	116	103.	Rash bright; tongue dry and brown in centre.
11th „ „ „	.	112	103·6.	Less injection of conjunctiva.
12th „ no „	.	128	103.	Tongue dry, brown, and cracked; diarrhœa in the evening; light coloured motions.
13th „ after „	.	108	102.	Bowels still loose.
14th „ no „	.	100	100·8.	
15th „ after „	.	104	101.	Tongue moist.
16th to 18th day, after aconitia		100	101—100.	

She left her bed on the 25th day, and the hospital on the 30th.

In this case diarrhœa came on at the pyrexial crisis, and it does not appear to have been provoked, or prolonged by the aconitia. It was unaccompanied by sickness.

Obs. 46.—Clara R—, æt. 21, admitted on the 7th day of an attack of typhus. Took $\frac{1}{200}$ of a grain of aconitia in a single dose, from the 8th to the 19th day inclusive.

		Pulse.	Resp.	Temp.	
7th day, no aconite	.	120	28	102·8.	
8th „ aconite .	.	120	30	104·2.	
9th „ Morn., aconite		112	40	103·8.	General mucous râles.
Even. „		84	48	104.	Tongue dry and brown.
10th „ Morn. „		112	40	103·8.	
Even. „		92	44	103·8.	
11th „ Morn. „		112	36	103·2.	
Even. „		96	42	103·4.	
12th „ Morn. „		92	40	101·4.	Pupils $\frac{1}{8}$; said she could not drink, and gulped a little; the throat was a little sore.
Even. „		104	42	103·6.	
13th „ Morn. „ } Even. „		108	44	103·4.	
14th „ „		108	44	103·4.	Pupils $\frac{1}{4}$; conjunctivæ injected; sordes.
15th „ Morn. „ } Even. „		104	36	101·6. / 100·4.	
16th „ Morn. „ } Even. „		96	36	99. / 99·2.	
17th „ Morn. „ } Even. „		84	28	98.	
18th „ Morn. „		76	28	97·6.	
Even. „		84	30		
19th „ Morn. „		80	24	97·6.	
Even. „		68	24	98.	

She subsequently had small glandular abscesses in the axillæ, pneumonia of the lower lobe of the right lung, and after recovering from these, paralysis of the intestines, with enormous gaseous distension and fœcal retention. She ultimately left the hospital strong, and nearly well of the intestinal affection.

Obs. 47.—Mary A. G—, æt. 16, admitted on the sixth day of an attack of typhus. On the 7th day the rash was developed. $\frac{1}{200}$ grain of aconitia was given every morning from the 8th to the 18th day inclusively.

		Pulse.	Resp.	Temp.	
7th day, before aconite was given .		124	32	102·2°.	
8th day, 1 hour after the aconite .		132	32	104·2.	
9th „ „ „ .		108	36	„	Five loose stools.
10th „ „ „ .		108	32	101·8.	
11th „ „ „ .		108	24	102.	
12th „ Morning „ .		108	24	102.	
Evening „ .		92	36	98·8.	
13th „ Morning „ .		100	40	102·4.	
14th „ Morning „ .		92	32	101·2.	
Evening „ .		82	28	98·7.	
15th „ Morning „ .		84	28	100.	
Evening „ .		76	30	99·2.	
16th „ Morning „ .		84	36	99·6.	
Evening „ .		74	24	98.	
17th „ Morning „ .		72	20	98·4.	
Evening „ .		72	24	98.	
18th „ Morning „ .		80	24	99.	
Evening „ .		74	22	98·4.	
19th „ Morning, Evening }	No aconite being taken	72	20	97·6.	
		100	32	98·8.	
20th „ Morning, Evening }	„ „	100	32	98·4.	
		68	24	98·4.	

The case was one of moderate severity, there was no diarrhœa after the 9th day. There was a little sickness on the 12th day. The tongue was dry and cracked on the 16th day, otherwise she expressed herself as feeling well. On the 18th day she took fish, and left the hospital on the 32nd day.

Obs. 48.—Anna C—, æt. 30, admitted on the 8th day of an attack of typhus. She took $\frac{1}{200}$ of a grain of aconitia from the 9th to the 20th day inclusively.

			Pulse.	Resp.	Temp.	
8th day, before the aconitia		.	124	28	104·8.	Rash developed; occasional crepitant râles at the bases of lungs.
9th „ after „		.	—	—	—	
10th „ Morning „		.	100	40	103·2.	Bowels very loose; enema opii.
Afternoon „		.	108	28	—	
12th „ . „		.	88	44	102·4.	
13th „ Morning „		.	84	44	99·8.	
Evening „		.	84	30	99·2.	
14th „ Morning „		.	92	40	100.	
Evening „		.	72	36	98·8.	
15th day, Morning „		.	72	44	99·4.	Hunger. Fish and ale.
Evening „		.	78	36	98·6.	
16th „ Morning „		.	84	44	99·4.	Slight congestion still at the bases of lungs.
Evening „		.	76	36	98·6.	
17th „ Evening „		.	82	36	98·4.	
18th „ Morning „		.	72	40	99.	Rash gone; more liveliness.
Evening „		.	94	30	97·4.	
19th „ Morning „		.	72	34	98·4.	
Evening „		.	82	36	98·4.	
20th „ Morning „		.	80	28	98·8.	
Evening „		.	84	36		
21st „ Morning „		.	76	36	98·6.	
Evening „		.	76	36		
22nd „ . „		.	76	36	98·4.	

The aconitia was omitted on 21st day, and full diet was ordered. The patient left the hospital well on the 29th day. The attack was one of moderate severity.

Obs. 49.—Elizabeth R—, æt. 16, admitted on the 5th day of a moderate attack of typhus. Took $\frac{1}{200}$ of a grain of aconitia from the 6th to the 14th day inclusively.

			Pulse.	Resp.	Temp.	
5th day, no aconitia	.	.	100	30	103·4.	Tongue dry in centre.
6th „ aconitia. Morn.	.	.	104	32	103·8.	Tongue dryish in centre.
Even.	.	.	80	36	103·6.	
7th „ Morn., before the aconitia		.	92	32	103.	
Even., after „		.	84	36	104.	
8th „ Morn., before „		.	84	32	102·8.	Tongue moist, almost clean.
Even., after „		.	84	36	103·8.	

			Pulse.	Resp.	Temp.	
9th day,	Morn., before the aconitia	}	84	32	102·8.	
	Even., after „	}				
10th „	Morn., before „	}	68	32	101.	
	Even., after „	}			100·4.	
11th „	Morn., before „	.	60	28	97.	
	Even., after „	.	—	—	100·4.	
12th „	Morn., before „	.	60	28	97.	
	Even., after „	.	60	24	98·2.	
13th „	Morn., before „	.	76	24	97.	
	Even., after „	.	66	24	97·6.	
14th „	Morn., before „	.	72	32	97.	Fish.
	Even., after „	.	64	24	97.	
15th „	no aconitia .	.	64	24	97.	Full diet.

She left bed on the 24th day, and the hospital on the 27th.

Obs. 50.—Bridget O'D—, æt. 19, admitted on the 7th day of an attack of typhus. Took $\frac{1}{200}$ of a grain of aconitia once daily from the 9th to the 13th day inclusively.

			Pulse.	Resp.	Temp.	
8th day,	no aconitia .	.	120	32	104·6°.	
9th „	„ Morn. .	.	104	32	104.	
	Even. .	.	84, weak.	24	104.	
10th „	Morn., before the aconitia .		80	28	102·2.	
	Even., after „	.	112	32	104.	
11th „	Morn., before „	.	116	32	103·4.	Pulse of fair strength two hours after the aconitia.
	Even., after „	.	120	32	102·4.	Conjunctiva injected.
12th „	Even., after „	.	96	32	103·4.	Tongue dry and brown.
13th „	Morn., before „	.	120	32	103.	Active congestion of both lungs as high as the scapular spine.
	Even., after „	.	96 very weak	44	101·4.	

Five hours after the aconitia, on the 13th day, she was in a state of partial collapse. The pulse was 100 and weak, the cardiac action was too feeble to be heard above the crepitant râles in the lungs, and the impulse was scarcely perceptible; vomiting and diarrhœa occurred at intervals during the afternoon and evening, and the skin was cold and clammy. The aconite was

discontinued, and ammonia and brandy given. The gastric disturbance had ceased next morning. She was flushed and the pulse was 120, much stronger; the respirations 40. In the evening the pulse was 128, and the respirations 68; the temperature 102·8°. Active pulmonary congestion was present throughout the lungs, and the next day the respirations were diminished to 48, but the pulse had risen to 148; the rash was vivid. Next day (the 16th) the respirations were 56, the pulse 148, temp. 104·6°; the cheeks were suffused with a dusky blush, and she died in the afternoon.

The subsequent history of this case is given to show the usual progress and termination of pulmonary congestion in typhus. It impended, as it commonly does in this disease, from the 7th day. The effects of aconite must, I think, be admitted to be present on the 13th day, and it certainly did not control the pulmonary affection; nor do I think that it hastened the fatal event, for the case is one which occurs very often under any treatment.

The foregoing cases of typhus, twenty in number, illustrate the full development of the disease in young subjects. I think it must be conceded that the crisis occurred early, and my impression at the time was that, compared generally with similar cases under different but simultaneous treatment, the aconite cases passed through the disease remarkably well. One (Obs. 49) died of pulmonary congestion; convalescence in another (Obs. 36) was prolonged by a large bed-sore; the rest left their beds between the 21st and the 25th day.

It will require a vast number of observations and comparisons to decide the question whether or not aconite has a more beneficial influence in the febrile state than other and dissimilar medicines; and the foregoing observations will, therefore, I hope, be accepted as a small contribution to this result. I could have wished that the respirations and temperature had been taken in every case, but this, under the circumstances, was more than we could possibly undertake. My thanks are due to Dr. W. Henderson, my resident assistant at the Fever Hospital, for his ready and efficient help in this matter.

Obs. 51.—Jane J—, æt. 20, admitted on the 7th day of an

attack of relapsing fever. She took the $\frac{1}{200}$ of a grain of aconitia from the 7th to the 16th day inclusively. She continued well and ate full diet from the 9th to the 14th day (the apyretic interval), the pulse being 84, the temperature normal, and the tongue moist. On the 14th day from the commencement of the primary fever[1] she had a relapse, and the secondary fever was more severe than the primary. At the acme, on the 16th day, the pulse was 120, temperature 104°, and there was slight delirium. On the 24th day the pulse was 116, temperature 102°. On the 27th she resumed full diet, and left the hospital on the 42nd day.

This case illustrates the general conclusion to be derived from the whole of the foregoing cases, viz. that if it be conceded that aconite ameliorates the febrile condition, it does not much control it; and it further shows that it cannot in any degree anticipate or cut short the pyrexial stage in a disease against which, if it did possess the antifebrifuge properties ascribed to it, its influence ought to be most marked.

I have said nothing respecting the action of aconite on the secretions, for I have but little evidence.

The frothy mucus (improperly called saliva) which appears in the mouth as one of the earliest symptoms of aconite poisoning, is an exsudation from the congested mucous membrane of the fauces and gullet, being chiefly forced up from the latter by the forcible contractions of its muscles. Afterwards there is usually a little trickling of clear glairy mucus, which is no doubt derived from the general mucous surface as well as from the glands contained within and beneath it. In the dog the exsudation of this clear fluid is much more copious under the influence of morphia. In Obs. 4 a large quantity of very acid fluid was found in the stomach, and it seems to have been secreted in consequence of the special action of the drug on the pneumogastric nerves. No such result occurred in the other fatal cases. The free evacuation of the contents of intestines (see Obs. 3 and 4) is due partly to increased watery secretion from the intestinal mucous membrane, and partly to increased peristaltic action. The urine is generally retained for a long

[1] In the majority of the patients under my care in this epidemic, the relapse occurred on the fourteenth day.

time, and then the quantity seems inordinate; where there is no relief by sweating, the quantity of this secretion, the watery constituent at least, is, no doubt, increased, since the amount of water exhaled from the lungs is diminished. The sweating observed in Cases 3 and 4 is, like the excretion of more water by the kidneys, a secondary effect.

ACONITINE POISONING.

TO THE EDITOR OF THE STANDARD.

Sir, — In a notorious case recently before the Courts in reference to Aconitine Poisoning, a very important and practical scientific point was not mentioned by counsel nor by the scientific experts; and I beg, therefore, to call your attention to the following facts, which I had the opportunity of observing and proving during a series of prolonged scientific researches (in the chemical laboratory of the University of Breslau, Germany) into the properties of the different kinds of alkaloids of the "Aconitum" plants.

Like the Opium, or the Papaver somniferum, and other poisonous plants, the Monkshood or Aconitum contains doubtless more than one poisonous alkaloid, each of which is different from the other. This fact, apparently, is not sufficiently recognised in England. Morson's Aconitine is not the real pure Aconitine as obtained in the laboratories and chemical works of the Continent Europe and America by a well-known process from Aconitum napellus, Aconitum ferox, or other kind of Monkshood. It differs toxicologically and constitutionally from pure Aconitine, and is manufactured according to a method which is unknown except to the manufacturer. This fact generally is acknowledged by scientific men on the Continent, who call Morson's Aconitine in their works "Pseudo-Aconitine," or "Acraconitine," and often "English Aconitine."

Supposing Morson's Aconitine to be employed in recipes made up on the basis of real aconitine, it is inevitable that fatal consequences will follow. Morson's preparation in its toxicological effects answers rather to those of concentrated extract of Monkshood which contains the whole of the virulent properties of this plant. According to the actual chemical nomenclature, this preparation has no right to the name of "Aconitine," just as extract of Opium cannot be called "Morphia," or an extract of Atropa belladonna "Atropine."

The difference of real Aconitine and Morson's preparation appears from the following facts :—

1. All samples of Aconitine received from different laboratories and chemical works all over the world show unanimous similarity in their constitution ; while the elementary analysis of Morson's preparation gives always other figures than those of real, pure Aconitine.

2. Morson's Aconitine differs in appearance and taste from the real Aconitine.

3. Real, pure Aconitine is different from Morson's preparation in its toxicological effects. I myself have made many experiments on animals, and I found that Morson's preparation is deadly in the very smallest dose, and in its effects resembles an extract of Monkshood, while real Aconitine, given in the same quantity, does not produce any serious symptoms.

A late lamented friend of mine some years ago committed suicide, and used for this purpose pure Aconitine. He took 0·5 grammes, and died from its effects only after several hours' suffering ; while if he had taken Morson's preparation 0·005 would probably have caused death in three or four hours.

To satisfy myself about the effects and symptoms produced by this alkaloid, I have myself taken progressively up to 0·05 grammes of Aconitine, and after four hours had quite recovered from its poisonous effects.

On the Continent 0·1 gramme is regarded as *dosis*

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THE MANUFACTURE OF ACONITIA.

TO THE EDITOR OF THE STANDARD.

SIR,—If further proof were wanting that Morson's aconitia is the active principle of the aconitum napellus, or A. ferox, and that which the Germans call aconitia is not, Dr. Springmühl's letter printed in to-day's issue of *The Standard* would, I think, supply it. A single extract from that letter is enough for the purpose:—"Morson's aconitine (*i.e.* aconitia) is deadly in very smallest dose, and in its effects resembles an extract of monkshood (*i.e.* aconitum napellus, the official plant); while real, pure aconitine (or aconitia) given in the same quantity does not produce any serious symptoms." A child may be safely trusted to distinguish between the true and the false here.

The truth must be told: English manufacturers have long ago succeeded in isolating the active principle of monkshood in pure colourless rhombic crystals; German manufacturers have hitherto been foiled in their attempts. Rather than admit a scientific defeat, they have called their own preparation true aconitine, and that prepared by the English manufacturer false aconitine (pseudo-aconitine). Dr. Springmühl's caution as to the dangor which may result from the similar use of two drugs so vastly differing in power is of little force in this country, where we only use the stronger; but it assumes an immense importance on the Continent, where the comparatively inert German aconitine is commonly used.

I hope Dr. Springmühl will use his influence with his professional brethren on the Continent to correct the erroneous impressions which have arisen there from the inappropriate name given by some of their chemists to English aconitia.

I am, Sir, your obedient servant,

JOHN HARLEY, M.D.

39, Brook-street, Grosvenor-square, W.

March 23, 1882.

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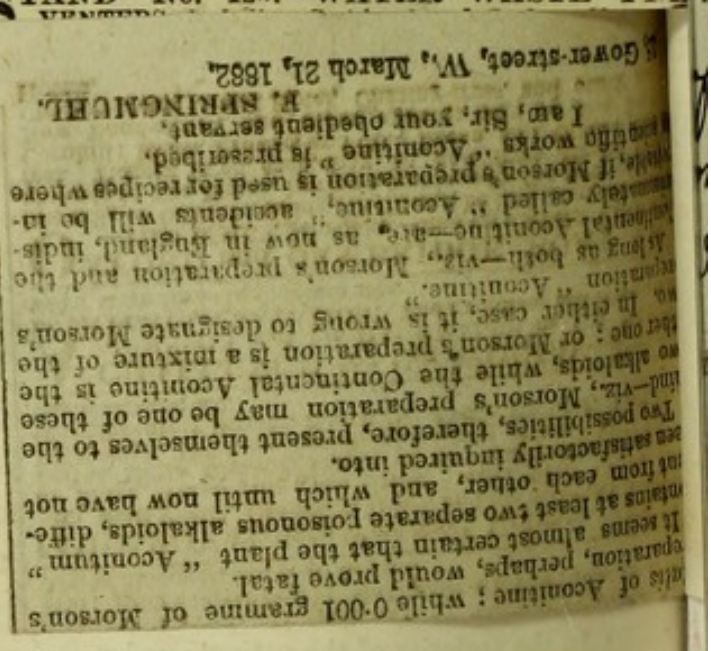

15 GOWER STREET,
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23/III 82

Dr. John Harley
39, Brook Street

Dear Sir,

From your letter to the Times of March 14. concerning „Aconitine" I perceived that there exists in England a misunderstanding regarding the term „Aconitine" and acknowledging your statement that Morson's Aconitine contains the whole of the virulent properties of the monkshood I addressed to the Home Secretary the enclosed letter, published to day in the Standard.

The matter being of great importance, I beg to call your attention to it

I am Sir, your obt Servant

F. Ferd. Springmühl

ON THE ACTION OF FOOL'S PARSLEY

(*ÆTHUSA CYNAPIUM*).[1]

By JOHN HARLEY, M.D. Lond., &c.

Synonyms.—*Lesser Hemlock.* L. *Cicutaria fatua, Cicuta minor.* G. *Gleisse, Hunds-petersilie, Kleiner Schierling.* F. *La petite Ciguë.*

A correct knowledge of the action of our indigenous plants on the human body, is a want which the Coroner's Court from time to time reveals to the discredit of scientific medicine. Between the well-known poisonous plants, with the properties of most of which we are fully acquainted, and the harmless ones, there is a class suspected but not proved to possess noxious qualities. So long as our knowledge of these is imperfect we shall be liable to form wrong conclusions, under shelter of which the poisoner may successfully elude justice. Society is already largely indebted to her medical members for numberless safeguards, and when the personal safety is still further ensured by the knowledge of the class of plants to which I have referred, we shall again deserve her thanks. In the endeavour to set forth the true character of one of our reputed poisonous plants, the following observations will, I trust, be received as a contribution to this knowledge. I was led to the investigation by the hope that I might find qualities that could be turned to medicinal use. How far my expectations have been satisfied, will be apparent from the sequel.

Fool's Parsley early obtained a place amongst the poisonous umbellifers, and has maintained it, unquestioned, for more than 300 years. Thus Lobel gave it the specific appellation

[1] Some portions of this paper were read in abstract at the Meeting of the British Association, July, 1873.

of *fatua* (Cicutaria fatua), and states[1] that it is "*equidem noxia et invisa olitoribus.*" And Bauhinus[2] has the following remark, and quotation from Dalechamps:—"*Venenosam et perniciosam esse plantam* (*cicutariam apii folio*) *testatur Dalechampius dicens; Esu Cicutæ quæ Apii hortensis specie incautum fefellerat, ego quendam novi ad extremum usque vitæ dementem factum.*"

Blair[3] attributes the following effects to the plant: vomiting, pains in the stomach and bowels, swelling of the body, and death.

Linnæus[4] admonishes "ut caveant coqui, ne Æthusæ folia loco apii petroselini in cibum adhibeant, cum dementent esa." And he branded the plant with the name Æthusa (*αἰθυσσω*) to indicate its burning properties. Add to this Lobel's appendage, and we have Æthusa fatua—a complete definition of an acrid narcotic.

Haller[5] makes the following statement:—"Multa exempla reperio anxietatis, singultus, etiam trimestrium deliriorum, soporis, stuporis, impotentiæ, vomitus, faucium constrictarum, spasmorum ventriculi, convulsionum, mortisque, *quæ omnia mala Æthusæ tribuuntur.*"

Henceforward, the bright green livery of Æthusa was regarded with suspicion, and sometimes with horror. Botanists, medical men, and toxicologists, unanimously accepted the statements of the great observers whose words I have quoted, and in conveying them to succeeding generations they took nothing from their force, while some transcribers have tinctured them with the glow of their own excited imaginations. Thus, P. R. Vicat,[6] M.D., who writes only a few years after Haller, says "Æthusa cynapium has been principally confounded with Parsley. So great is the number of tragic accidents occasioned by this

[1] 'Stirpium Adversaria nova,' p. 327. London, 1570.

[2] 'Historia Plantarum,' vol. iii, p. 180. Ebroduni, 1651.

[3] 'Pharmaco-botanology,' Decad. v, p. 213. Lond., 1727. The four "Experiments" by which "the pernicious effects of *Cicuta minor Petroselino similis* were made known to this author," illustrate the easy manner in which Æthusa has been repeatedly convicted of poisonous properties. People died or were ill after an ordinary meal, or a "diet drink" of green herbs; Cicuta minor grew in the garden which supplied the pot-herbs, and it was therefore *suspected*. This was enough; *conviction* followed at once, as a matter of course, and without an iota more of evidence.

[4] 'Flora Sueccica,' p. 84. Stockholmiæ, 1745.

[5] 'Hist. Stirpium Indig., Helvetiæ,' vol. i, p. 336. Bernæ, 1768.

[6] 'Hist. des Plantes Vénéneuses de la Suisse.' Yverdon, 1776. Ebrodunum again!

unfortunate error that the great botanists, Haller and Trew, think that the accidents which are attributed to Hemlock, mistaken for parsley, ought almost always to be referred to the lesser hemlock; this conjecture is very probable" (p. 254). He then gives a list of the symptoms "produced by the root, and still more by the herb," which is not only longer but also much more terrible than any I have previously quoted. Another botanical author goes go so far as to state that "Æthusa is a very dangerous caustic," even "when applied externally." A more modern writer ('Chambers's Cyclopædia,' Ed. 5) remarks, the "*lesser* hemlock is not less dangerous than the *greater;* it is even supposed to be more violent, as well as more hasty in its operation."

To-day the little plant is found in every work on toxicology associated with the apparent victims of its reputed deadly power; and as a history and critical examination of the cases in which it is thus associated form a necessary preface to my own observations, I will first give a brief account and analysis of them, and hope that this will not prove altogether uninteresting.

I take them in chronological order:—

1. "Two boys, the one 6, and the other 4 years of age, residing in Ratisbon, ate the root of fool's parsley in April. The elder was quickly seized with severe pain over the stomach. When he was brought home, the whole body was frightfully swollen and livid; the respiration was difficult and short, and he died about midnight. The younger boy vomited, and exhibited some confusion of speech, but was soon well."[1]

These two cases are evidently those related by Vicat (see 3).

2. Riviere[2] relates that a whole family fell ill from eating the plant. The father was taken the same day with headache and stupefaction, vomiting and diarrhœa, and small weak pulse. All the rest were more or less ill. The next day a daughter, aged 7 years, died first, and then the father, whose death was preceded by cold extremities and an imperceptible pulse. A blackish fluid was found in the stomach; the liver was hard and yellow; the spleen livid; the mouth black. A second

[1] 'Commercium literaricum noricum,' Norimb., 1731. 'Sem. Prius. Spec.,' 25, p. 178, quoted by Dr. Karl Wibmer, 'Die Wirkung der Arzneimittel und Gifte,' vol. i, p. 62.

[2] 'Hist. de l'Acad. Roy. des Sciences à Montpellier,' 1766, tome i, p. 170.

daughter, aged 16, also died the same day, after great restlessness, headache, vomiting, and fever. The mother and three other children shared in the poisoning, but were saved by theriaca.

3. "A lad, 6 years old, having at 4 p.m. eaten this herb, which he had mistaken for parsley, commenced immediately afterwards to utter agonising cries, and complained of cramps in the stomach. While they carried him from the country to his father the whole body became excessively inflated and livid; the respiration every minute more difficult and short, and he died about midnight. Another child of four years of age, who was poisoned in the same manner, fortunately vomited the herb. This, however, did not prevent him from becoming delirious, holding extravagant propositions, and believing that he saw a number of dogs and cats; and although the physician arrived the day after, he was still in sufficient time to save the patient."[1]

The following three cases are given by Dr. Rudolph Buchhave in his treatise on "The Noxious Effects of *Æthusa cynapium* on the Human Body."[2] They are very interesting, as showing how readily the effects of one plant may be mistaken for those of another:

4. A woman, æt. 40, took, according to prescription, three fluid ounces of a decoction of hemlock (one ounce of the herb in thirty-two ounces of water) daily for three or four weeks, at the end of which time she complained "that the medicine always caused tremors, vertigo, heaviness of the eyes, headache, nausea, colicky pains, vomiting, and muscular weakness." Dr. Buchhave "*tantorum malorum anxius, herbasque rudi modo inscisas inspiciens, facile detexit magnam Æthusæ partem conio esse admixtam.*" "Hence," he remarks, "the cause of these untoward symptoms was apparent." The apothecary was put on his guard, other conium leaves were procured, and used as before. The above-mentioned effects were no longer experienced, and "the malignant ulcers," with which the patient was afflicted, "yielded laudable pus," and healed within two months."

5. A young woman in the advanced stage of phthisis took three ounces of a decoction of hemlock (one ounce and a half

[1] Vicat, 'Hist. des Plant. Vénén. de la Suisse,' p. 225, 1776.

[2] 'Acta Regiæ Societatis Medicæ Hauniensis,' vol. i, p. 51. Hauniæ, 1783.

boiled in thirty-two ounces of water to two pounds) every two hours for fourteen days, when she complained of increased difficulty of breathing, headache, colicky pains, nausea, vomiting, and lassitude and torpor of the limbs. "Mindful of the fraudulence of the apothecary, I did not hesitate," Dr. Buchhave says, "to ascribe these strange effects to the decoction. Therefore, having put the cut herb into water, when the leaves were expanded, those of Conium and Æthusa were easily distinguished" (p. 56). She was now supplied with the "true herb," and no longer experienced any unpleasant symptoms.

6. For a young man, æt. 20, affected with syphilis, Dr. Buchhave prescribed mercurial sublimate dissolved in spirit of wine and decoction of hemlock, prepared and used in the same way as in the first case. After a time the same symptoms arose, viz. colicky pains, nausea, headache, anorexia, giddiness, and great languor and debility of the whole body, symptoms which were increased by each dose of the medicine. This time the druggist was exonerated :—"*Pharmacopolæ male credere nequivi, quoniam de patrata admonitus fraude, sincerius in posterum agere promiserat. Herbæ præterea admodum minutim erant inscisæ, adeo ut indagationi locus non esset*" (p. 58). After two months the patient returned home, and, following out the original prescription, took on a certain morning three ounces of a decoction prepared from another sample of hemlock. This produced the same symptoms in a greater degree—very great debility, giddiness, tremor, spasms, convulsions, and faintness; such, however, was the *mother's* account of her son's condition, and it was doubtless overdrawn, for, without seeing the patient, Dr. Buchhave, in order to assure himself that the decoction was the cause of these symptoms, directed a repetition of the same dose next day. It was taken, and the symptoms reappeared. The suspected hemlock was now set aside, and the next sample proved innocuous.

It appears from these three cases—1st, That a certain train of alarming but evanescent symptoms uniformly followed the draught of hemlock decoction, and that they ceased or returned on using a sample of the herb different from that which originally produced them; 2ndly, That the herb was both dried and finely divided, and obtained from an apothecary who, independently of Dr. Buchhave's admonition, was doubtless

well acquainted with the characters of hemlock; and 3rdly, That one patient (6) was actually taking corrosive sublimate with the hemlock decoction; that another was the subject of syphilitic ulceration or lupus—"diu afflixerant ulcera faciei collique carcinomatica, ichor valde fœtens fundentia, margine dura, locaque vicina continuo magis magisque depascentia" (p. 53)—and had been treated with a variety of drugs, of which corrosive sublimate was most likely one; and, lastly, in reference to the second case (5), that nausea, vomiting, and colicky pains are not uncommon associates of advanced phthisis.

Now, with regard to the symptoms above mentioned, they are clearly and unmistakably those of hemlock. Their severity and evanescence are highly characteristic. "Tremor, convulsions, and faintness" (6), are a mother's words expressive of the weak, shaky, staggering, and expressionless condition of a person under the influence of hemlock. The gastro-intestinal irritation is accounted for, in two cases at least, independently of conium; but they may, nevertheless, have been caused by it. I have myself observed them when I have prescribed preparations which contain a large quantity of the nauseous oleo-resin of the leaf; or when the conia is set free by an alkali, the former acting as an irritant. Schroff[1] notices gastro-intestinal irritation as an effect of the internal use of conia.

The non-occurrence of the symptoms on exchanging one sample of hemlock for another is, moreover, in strict accordance with what we know of the activity of the freshly dried plant, and the inertness of that which has been kept for a time.

But Dr. Buchhave did not believe that hemlock produced these effects, although he tells us that his contemporaries attributed identical effects to this plant. He was too much impressed with his own idea, that some other umbelliferous plant was the cause, to recognise any other. The following passage is worthy of quotation, because it proves how easily a careful observer may, by the force of a preconceived idea, evade the truth. He remarks—"Symptomata enim infausta conio, interne adhibito, a novissimis observatoribus imputata, sunt: appetitus abolitus, debilitas totius corporis, brachiorum præcipue et pedum, vertigo, tremor oculorum et totius corporis, visus de-

[1] 'Reil Mat. Med. der Chem. Pflanzenstoffe,' p. 135.

bilitatus. Hæc vero cum apprime conveniant cum dictis, ab Æthusa excitatis, malis haud falso videmur ratiocinari, si Æthusæ, vel aliæ ejusdem faraginis plantæ, per ignorantiam substitutæ, eadem adscribamus. Innumera si addas, tum veterum tum recentissimorum, *de Conii innocentia testimonia*, quæ, ut perquam nota, hic enumerare supersedere possum, rem extra omnem dubitationis aleam invenias positam, certissimeque de Conio colligas: si non juverit, sane non nocuerit,[1] etiam magna dosi porrectum. Fida edoctus experientia hoc adfirmo: Ipse namque ægris decoctum Conii fortissimum ad unc. vi, et succum ejus recenter expressum ad unc. ii sæpius quotidie exhibui, nihilque inde mali unquam vidi. *Infortunia igitur in ægris meis visa, non sane Conio, culpa omnimode vacuo, sed Æthusæ merito et debite sunt imputanda*" (p. 65 *et seq.*).

It therefore appears conclusively that so long as hemlock did not produce coneism,[2] Dr. Buchhave regarded the plant in use as "*herba vera*," and that when it did, as "*herba admixta*."

But since there is nothing in the foregoing to preclude the supposition that Æthusa may produce effects identical with those of conium, and even be the more potent plant of the two (p. 65), it will be necessary to inquire into the evidence of admixture. I have quoted Dr. Buchhave's own words. On one occasion he easily detected, by a rough inspection of the cut herbs, that a large quantity of Æthusa was mixed with the conium. On another we learn *how* he satisfied himself that Æthusa was present:—"*In aquam igitur tepidam missis herbis inscisis foliisque inde expansis, facile distinguebantur Conii et Æthusa*" (p. 56). When the cut and dried leaves were expanded in water he was able to say, "This leaflet is hemlock, and this one fool's parsley."

Now, if we compare the uninjured leaflets of the fresh plants, laid out side by side upon a sheet of paper, we shall see that the distinction, even then, cannot be made hastily. The accompanying figures were carefully drawn from nature by Mr. Fitch. The leaflets compared with Æthusa are those of the radical leaves of a yearling conium; but if the stem leaves of the biennial plant be used instead, the distinction is still more difficult, and,

[1] Stoerkius, Lib. i, De Cicut., pp. 6, 12; Lib. ii, pluribus in locis. Continuat. Exper., pp. 79, 206, 236. Hallerus, 'Hist. Strip. indig. Helvet.,' T. i, p. 342.

[2] ὠνειον, hemlock.

in the case of the dried plants at best but doubtful, turning, as it does, upon the single fact that the incisions of the leaflets are a trifle more acute in conium. When, therefore, Dr. Buchhave uses the words I have quoted respecting the dried and incised leaves, and I find the druggist on his guard, I am obliged to reject the evidence of admixture as unsatisfactory.

7. John Stevenson relates[1] the following case:—Two ladies, of Castle Donnington, ate the leaves of the lesser hemlock "with some salad, wherein it had been put by mistake with common parsley, for which it had grown and been gathered." The following alarming symptoms soon appeared:—Nausea, headache, giddiness, somnolency interrupted by frequent startings and excessive agitations, a sensation of pungent heat in the mouth, throat, and stomach; dysphagia, thirst, anorexia, numbness and tremor of the lower extremities, and general lethargy. The herb grew in a garden shaded by spreading trees and surrounding buildings. These are the whole of the facts narrated, and we have here an undoubted case of vegetable poisoning. Mr. Stevenson clearly distinguishes "that dangerous narcotic herb, that pernicious vegetable, the lesser hemlock," from its allies; but I think that a more pernicious vegetable was at work in this case. It is more probable that a leaf or two of aconite was gathered with the salad, than that the ladies should have eaten such a large quantity of salad as, granting a fair proportion of Æthusa having poisonous properties in a moderate degree, would be required to produce the symptoms. This explanation receives support from the following statement:—"Had the mistake remained undiscovered it is probable that the error would have produced the most tragical event." How was the mistake discovered? No doubt by the speedy tingling of the mouth and throat.

8. The following case is given in 'Rust's Magazin der Heilkunde':[2]—A girl, æt. 12, ate a little handful of the plant. In the evening she experienced nausea, headache, and vomiting of greenish matter, vertigo, heat, confusion, and inability to maintain the erect posture. Pulse full and quick; the face speckled, red, and swollen. On the third day there was pain in the left side of the chest, and leeches were applied. On the

[1] 'Medical and Physical Journal,' vol. xiv, p. 425, 1805.

[2] 1826, 21, Band 2, Heft S, 248.

fourth day anxious breathing, breast pain, and prostration. On the fifth day, following a purge, relief, and speedy convalescence.

Here the early symptoms of an attack of pleurisy or pleuro-pneumonia are attributed to vegetable poisoning. (See also Case 13.)

9. Meyer[1] relates the following:—In the forenoon of an August day, in the year 1824, nine children, from one and a quarter to seven years of age, ate of the root of *Æthusa cynapium*. They soon became alarmed and restless, complained of pains in the head and belly, and experienced vomiting and painful purging. About midday one was found unconscious, and another with green matter about the mouth and anus, both suffering with blood-stained mucus purging. Notwithstanding treatment the two youngest children, each one and a quarter year old, died in violent convulsions, the one at four and the other at eight o'clock. When first seen by the medical man, at midnight, all had a moist tongue, dryness of the fauces, and a bitter taste, and all complained of moving pains in the pit of the stomach and œsophagus; the belly was more or less swollen and sensitive, especially in the hepatic region. Frontal pain, thirst, alarm, and exhaustion were present; the pulse was quick, small, hardish, and irregular; the breathing was scarcely affected; the temperature was raised in two; the face of most flushed, changeable, collapsed; the eyes motionless, glazed, injected; the pupils tolerably sensitive to the light ("nur bei diesen dilatirt"). There was no sign of convulsion or unconsciousness, and the speech was free. The corpses of the two youngest children were already rigid and nearly cold. Two hours later most of the patients were tranquil. Later on in the day five were convalescent, having only a little frontal headache, which continued for the following two days. The two other children still complained of colic and diarrhœa, but they recovered in the course of a few days.

At the post-mortem examination of the younger children the abdomen of one was greatly swollen and purple; in the other these effects were less conspicuous; the brain, meninges, and sinuses were congested with black fluid blood; the lungs normal; the right heart gorged with black fluid blood. The stomach was reddish externally, and contained, in the one case,

[1] 'Neue Breslauer-Samml.,' 1829, S. 178, 1 Band.

some milk and root-fibres; in the other there was only yellowish mucus. There was a patch of congestion in the one and many red spots in the other. The whole of the small intestine was finely injected; the liver and spleen much engorged; the abdominal viscera were stained with bright yellow spots.

10. The next case is related by Wittke.[1] Two children, aged respectively four and eight years, got, "through enjoyment of the fresh juice of the root (durch den Genuss des frischen Safts der Wurzel)" of *Æthusa cynapium*, the following symptoms of illness:—The youngest, severe epileptic convulsions, flushed face, dilated pupils; pulse small and frequent; great heat of the body. The elder, pallor of the face; violent vomiting of frothy milk-white matter; eyes fixed and vacant, pupils widely dilated and insensible; cold extremities; unconsciousness. Both recovered under suitable treatment.

Some succulent tuber quite different from the woody root of Æthusa must have been eaten in this case (see p. 79).

The next two cases[2] form the text of M. Lalé's "Mémoire sur l'action délétère de la petite ciguë, *Æthusa cynapium*," presented to the Académie Royale de Médecine, January, 1830. The patients are said to have eaten the fool's parsley in a salad, and, as I gather from the account, at the same meal.

11. In the one case, vertigo, nausea, coma, cold sweats, coldness of the extremities, and death, followed an hour after the meal. Large ecchymoses upon the whole of the body, inflammation of the stomach and peritoneum, engorgement of the spleen, and plethora of the heart and lungs, were found at the necroscopy.

12. In the second case "the Æthusa was rejected by vomitings, but the patient was attacked with a chronic gastritis, *avant son empoisonnement*, and died some weeks afterwards. The body was extremely emaciated; there was inflammation of the peritoneum and intestines; suppuration of the internal membrane of the stomach; sloughy spots upon several points of the small intestine, and scirrhous masses in the mesentery,"—or, in more modern language, ulceration of Peyer's patches, enlargement of the mesenteric glands, and the usual effects of enteric fever.

[1] 'Hufeland's Journal,' 1829, Sept., S. 122.

[2] 'Archiv. gén. de Méd.,' 1830.

Here are two individuals, members, it appears, of the same family, clearly suffering from latent enteric fever. After a meal the one dies of perforation of the bowel within an hour,—an accident which has often happened, and will often happen again under the same circumstances. No mention, it is true, is made of ulceration of the intestines, but, as peritonitis presented itself on opening the abdomen, probably the intestines were not opened. The other effects of enteric fever are mentioned. On the assumption of poisoning we are asked to believe that Æthusa caused peritonitis within an hour, an effect which neither corrosive sublimate nor arsenic could produce in ten times that period, and which no vegetable irritant could induce until it had previously destroyed the mucous membrane by ulceration.

The following is a communication from Mr. Lowe, a surgeon at Preston, to Mr. Curtis :[1]

13. Mr. Freckleton, æt. 35, a strong, healthy man, a publican, ate a handful of fool's parsley with about as much lettuce ; severe colic came on within ten minutes ; there was so much languor that he had difficulty in walking home ; giddiness, confused and double vision followed. After seven hours he took an emetic, which "brought up, he thought, all the fool's parsley, but none of the lettuce." He was relieved, but passed a restless night ; next day he had much pain in the head and eyes, which were inflamed and bloodshotten ; and the face was affected with a patchy cellular inflammation, passing into regular erysipelas. He was told that he had eaten hemlock, but, to be satisfied, Mr. Lowe "accompanied him to the garden, where he had gathered the plant, and found it to be *Æthusa cynapium.*"

Here we have the proprietor of an inn, only forty years ago, eating a handful of fool's parsley, and meantime deceiving his sight, taste and smell, with the idea that he was all the while eating parsley. Impossible ! Those who eat handfuls of parsley at a sitting have acquired a taste for the herb which cannot be thus readily deceived. I fancy I hear the medical attendant say to his patient, "Oh ! it cannot be the parsley which has disagreed with you ; see here, there is plenty of Æthusa about, and a most poisonous plant it is ; you must have gathered some of it with your parsley and lettuce." However this may have

[1] Stephenson and Churchill's 'Medical Botany,' art. "Æthusa," vol. i, 1834.

been, I take this case to be one of gastric disturbance, preceding, as usual, an attack of erysipelas. (See also Case 8.)

14. A family ate for supper the leaves of *Æthusa cynapium* by mistake for parsley. All soon fell ill and experienced giddiness, ringing in the ears, nausea, trembling of the limbs, followed by a cold sweat; the intellect and visual powers were disordered, and fainting followed. They were all speedily relieved by emetics, excepting one young girl, who had spasmodic convulsions of the arms, intermittent pulse, dilated pupils, and pallor, except the thigh, which was covered with violet spots. When consciousness was restored she complained of excessive headache, slight colic, and numbness under the thick of the limbs, with a feeling of enormous weight. The patient recovered, notwithstanding, the next day.[1]

The symptoms above detailed so exactly agree with those induced by aconite, that I do not hesitate to attribute them to this plant.

15. "A woman gave two of her children some soup in which she had boiled the root of *Æthusa cynapium*, mistaking it for parsley. They were both seized with severe pain in the abdomen, and the next morning one of them, a boy, aged eight years, was in a state of perfect unconsciousness, and his jaws were spasmodically fixed. The abdomen was swollen; there was bloody mucus, with obstinate purging, the extremities were cold, and the whole body convulsed. He died in twenty-four hours. The only appearances met with, were redness of the lining membrane of the gullet and windpipe, with slight congestion of the stomach and duodenum."[2]

In elucidation of the cause of poisoning, we may ask why the woman intended to use parsley root? Was it early spring time, when the plants had not yet repaired the injuries of winter, and leaves were scarce? If so, there were no Æthusa roots with which to confound those of parsley.

16. In the month of May three children, all under six years of age, ate the "bulbs" of *Æthusa cynapium* for young turnips.[3] They were suddenly and simultaneously attacked

[1] 'Compte-rendu des travaux de la Société de Méd. de Lyon depius le 11 Août, 1830, jusqu'au Janvier, 1833,' quoted 'Schmidt's Jahrbücher,' vol. xx, 1838, p. 368.

[2] 'Taylor on Poisons,' 2nd edn., p. 815, quoted from 'Medicinisches Jahrbuch.'

[3] 'Medical Times,' 1848, vol. xii, p. 408.

with pain in the epigastrium, nausea, and griping. Delirium and trismus followed in the eldest, aged five years, and he died insensible an hour after the symptoms appeared and before he was seen by a medical man. The two younger children, aged three years, vomited, and were well the next day. Mr. Evan Thomas remarks, "I had my doubts whether the substance alluded to (the bulbs of Æthusa) was the cause of death, till the corroborative evidence with reference to the survivors was brought forward at the coroner's inquest." What this evidence was he does not mention. Mr. Thomas afterwards, through Professor Forbes, made himself acquainted with *Æthusa cynapium*, in order to make some experiments on its action. Having obtained some bulbs in May and expressed the juice, he injected it, in quantities of two ounces, into the stomachs of dogs and cats through wounds in the œsophagus, which was afterwards ligatured. Only one animal survived, the others died in from one to four hours, violent spasms and efforts to vomit being the only observable symptoms.

From these experiments (see also one by Orfila[1]) nothing more can be inferred than that the poison, whatever it was, had no local irritant action, and that ligature of the œsophagus, like ligature of the intestine, is usually a fatal operation, and is necessarily attended with some amount of disturbance to the alimentary canal. But the main question is, "What root have we to do with here?" The little tapering root of Æthusa, which at its junction with the stem at no time exceeds a goose-quill in size, could not be mistaken, even by a child of six years of age, for a young turnip, nor would it suggest the idea of a bulb to any person; moreover, in the most succulent condition of the plant it is so woody and dry that it would take an immense number to furnish a single ounce of juice. Add to this the statement that juice in abundance was obtained from the bulbs in May, at the time when the little annual plant is springing up, and has a root about the thickness of a stout thread, and then the conclusion will be obvious, that no blame or virtue can be attributed to the root of Æthusa in this case. (See Cases 10 and 15.)

Dr. H. S. Kane relates[2] "a rare case of poisoning," and concludes that the child had eaten the leaves of *Œnanthe crocata* or

[1] 'Traité des Poisons.' Tome ii, p. 314. Paris, 1818.

[2] 'Medical Times and Gazette,' 1869, vol. ii, p. 379.

Æthusa cynapium; but there is absolutely no evidence of the ingestion of either, and the symptoms are typical of the action of strychnia.

In conclusion of this part of my paper I transcribe the following from the most modern of complete works on chemistry,[1] article "Cynapine:"—"A poisonous alkali, contained, according to Ficinus ('Magazin für Pharmacie,' xx, p. 357) in *Æthusa cynapium*. It is said to crystallize in rhombic prisms, to have an alkaline reaction, to be soluble in water and alcohol, and to form a crystallizable sulphate." This is brief enough, but it nevertheless overpasses the mark, for on turning to 'Gieger's Magazine' I find that the word *poisonous* is an embellishment of the transcriber. Ficinus says nothing about its poisonous properties, nor, in fact, did he ever, as far as we know, make any attempt to ascertain its effects on the animal body.

Such are the charges which I find made against *Æthusa cynapium*. I have already commented on some of the evidence in passing, but it will be well, I think, to take now a general review of the whole, in order to come to a just conclusion.

In the foregoing sixteen cases of reputed poisoning, thirty-eight persons were involved, and ten died. Of the fatal cases all but four were young children, varying in age from fifteen months to eight years. Leicestershire, if not Lancashire, Montpellier, and Ratisbon, mark the extreme limits of the area within which the accidents have occurred. Twenty-one persons are said to have eaten the leaves or a decoction of them (Cases 2, 3, 4, 5, 6, 7, 8, 11, 12, 13, and 14), and eighteen the root or a decoction of it (Cases 1, 9, 10, 15, and 16); eleven mistook the leaves for parsley.

In only two cases (5 and 6) is any direct evidence of the identification of the Æthusa offered, and in these I have shown that it is unsatisfactory. In Case 16 means were taken to identify the plant subsequently, and for the purpose of collecting the roots; but if it be granted that the plant was identified, it is clear that the roots were not, otherwise the medical man would not have called them bulbs.

The first-recorded cases (1, identical with 3, and always quoted) of poisoning occurred before Linnæus distinguished the plant, as Æthusa, from amongst a number of umbelliferous

[1] 'Watts's Dictionary,' vol. ii.

plants commonly confused; and the five succeeding cases happened during the next forty years. We may, therefore, very properly apply to these cases the criticism which Buchhave has used to prove "ut conium nunquam nocuisse."

"His predecessors," he says, "attributed noxious properties to Conium, because they confused it with Æthusa cynapium, Cicuta virosa, Chærophyllum, Phellandrium, and other plants, having never been taught the botanical characters by which the umbelliferous plants were to be distinguished." Now, if this observation were applicable to Hemlock, famous since the days of the Athenian Republic, and not only the most distinguished, but also the most distinguishable plant of the umbellifers, how much more was it applicable to the lesser hemlock, one of the humblest plants of its order—the obscure little Æthusa. But even granting that the medical men of the eighteenth century possessed as much botanical skill as those of the nineteenth, it will be neither uncourteous to the latter nor unfair to the former to say that not one in ten were able to distinguish the Æthusa from hemlock and several other umbelliferous plants; and it would be a severe stretch of imagination to assume that all the recorded cases of poisoning happened only in the practice of men who were specially skilled in botany. Nor, indeed, would it be disparaging to the attainments of the most accomplished botanist to assert that it would be needful for him to make a very close and careful comparison of the chewed or half-digested fragments of the leaves of the umbelliferous plant in question with those of other members of the order, before he could positively declare the identity of the former. What evidence of this identification have we in cases before us? Almost none. We know that Dr. Buchhave (Cases 4 and 5) settled the question by a "rough inspection" of the incised plants; we see Mr. Lowe (Case 13) walking in the garden with his suffering patient and recognising the growing Æthusa; and we learn from another (Case 7) the extraordinary fact that Æthusa was grown, gathered, and eaten for parsley. This is the whole of the evidence respecting the identification of the plant. I have already commented on it. In all the remaining cases we have the bare assertion that Æthusa is the poison present. A little examination of Cases 1 and 16—the first and last, the circumstances attending which may be regarded as common to

several others (especially 9), and to similar instances of poisoning generally—will serve as an illustration of the kind of evidence which we are called upon to believe. In the first case two children are left alone in the garden or open country, and they eat some poisonous plant; the eldest is too young, if not too ill, to give a reliable account of the cause of the accident. They are taken home to the father. *The day after*, the doctor appears on the scene for the first time, when the elder child is dead and the younger is recovering. No post-mortem examination of the body is made. How did the medical man find out that Æthusa was the cause of the poisoning? He does not tell us, and we can only infer that he learnt it from the father, that the father learnt it from the neighbours, and the neighbours from the victim himself—a child six years old. If we are to believe the one account (1), the accident happened in April, and the *roots* were the cause; if we adopt the other report (3) as the more accurate, we must substitute the *herb* for the root, and assent to the statement that a child six years of age had already acquired a taste for raw parsley. The time of year, however, is fatal to both accounts. Spring is not, I believe, earlier at Regensberg than in England, and we certainly should not find fool's parsley, as a developed plant, in either garden or hedgerow in England at that time of year.

Turning to the other cases, we find that several of them are unmistakably referable to some other causes. Thus, as I have shown, the evanescent symptoms in 4, 5, and 6 are due to hemlock; those of cases 7 and 14 are attributable to aconite. In 11 and 12 the ingestion of the herb was in each case but an incident—harmless, probably, in itself—in the course of an attack of enteric fever; and the symptoms in 8 and 13 may be regarded as premonitory, in the one of an attack of pleuro-pneumonia, and in the other of an attack of erysipelas.[1] In five (3, 9, 10, 15, and 16) of the seven remaining cases it is

[1] If we consider how very insidiously ulceration of the stomach and intestines often progresses until perforation impends or actually occurs, and how often the event is determined by a meal; and again, that febrile affections of all kinds are not uncommonly preceded by violent gastric disturbance, we shall not feel surprised that a suspicion of poisoning should first attach itself to such cases, and that this suspicion should easily pass into conviction if it can be shown that anything of a doubtful nature has been taken as food.

remarkable that the poisoning is ascribed to the root. I have already shown, under Case 16, that this charge is not tenable. Case 10 strengthens the remarks which I have made, for it is clear that some succulent tuber, such as that of *Ranunculus bulbosus* or *Ficaria,* must have been eaten, since the root of Æthusa is too small and too dry to furnish any enjoyment of its root.

In conclusion of this portion of my investigation I am bound to say that there is no evidence of poisoning by *Æthusa cynapium* in any one of the fifteen or sixteen instances adduced. To an indolent and unreflecting mind the evidence of poisoning by Æthusa will probably be considered satisfactory in every case, for persons of this temperament are always the willing slaves of prejudice and the easy victims of error; but that such evidence should be accepted by the learned profession of medicine, and adopted as an article of its faith, is as serious an imputation against its judgment and intelligence as can well be made. Yet I cannot say that the imputation is unjust; and I fear we must acknowledge that in this matter, as in many others, tradition and the habit of easy belief, to which we are all so carefully trained, have so involved our perception in their deep, broad shadows, that our judgment has been thoroughly and imperceptibly betrayed.

I now gladly turn from this ungrateful task of criticism to the more agreeable occupation of detailing the results of my own observations on the properties of Æthusa.

They have been made with the juice of the entire plant; with tinctures prepared from both ripe and green fruit; with a fluid extract prepared with the view of separating any cynapine or other active principle that may have been left in the plant after the expression of the juice; and with the oleo-resin.

The Juice.—On the 20th August, 1867, Mr. Buckle, of Gray's Inn Road, expressed for me the juice from a bundle of the herb, which had been gathered in Essex the previous day. The plants were entire, including the small, woody, tapering root, and the fruit was just forming. Although a pressure of about 100 tons was applied, and the marc was quite dry, the yield of juice was small, amounting to only 50 per cent. The crude juice was thick, turbid, of a dingy green colour, acid,

and of sp. gr. 1070. It had a faint, not unpleasant odour, of the bruised plant. After standing twenty-four hours there was a clear, dark, sherry-coloured fluid, only the eighth of an inch in depth. The filtrate abounded in sugar and albumen, and contained phosphates, sulphates, and chlorides. Amongst the bases magnesia and lime were abundant. When boiled with either acids or alkalies the juice evolved no remarkable odour. The turbid juice was mixed (as in the preparation of the Succus Conii, P. B.) with rectified spirit, in the proportion of three volumes of the former to one of the latter, and, without any separation of the solid matter the mixture was given in this form to the patients. When filtered this preserved juice had the colour of dark brandy. It was pleasantly bitter-sweet, like some kinds of sherry; its peculiar flavour, which was at first not unpleasant, adhered to the palate, and became rather disagreeable. A fluid ounce of the filtered juice yielded 52 grains of hard, yellow-brown extract, soluble in water. Potash failed to elicit the faintest odour of Conia[1] (see also Tincture of the fruit).

Observation 1.—J. W—, a weakly young man, troubled with frequent seminal emissions, took three and a half fluid drachms of the Æthusa juice, and, having sat still for the first hour, strolled out during the second. At the end of an hour the oscillating pupils contracted a very little more than they were observed to do before the dose, but beyond this there was no effect whatever. Four fluid drachms of Succus Conii produced a moderate effect upon this patient.

Observation 2.—John T. B—, æt. 22, the subject of sexual debility from excessive self-abuse, but otherwise strong and healthy, and in whom six drachms of Succus Conii produced moderate coneism, took the Æthusa juice for a time in doses increased from ninety minims to four drachms, an hour before breakfast every other day. No effects whatever followed.

Observation 3.—Clara L—, an active but slightly developed child, æt. 7, the subject of interstitial keratitis, and in whom

[1] "Conium maculatum, Phellandrium aquaticum, et Æthusa cynapium, sont extrêmement dangereuses. Elles renferment le principe toxique coniin ou cicutine." 'Étude sur la Ciguë,' par Martin-Damourette et Pelvet. Paris, 1870; and 'Gazette Hebdom.,' Oct., 1871, p. 615.

six drachms of Succus Conii produced only moderate effects, took two doses, one of three drachms and the other of four drachms, of the Æthusa juice about two hours after breakfast, on separate days. Beyond a slight temporary rise of pulse, due to the alcohol, there was no effect. The patient subsequently took Tincture A of the fruit. (See Observation 10 on Tincture A.)

Observation 4.—W. W—, æt. 19, an active healthy lad, troubled with frequent seminal emissions. Six drachms of Succus Conii, thirty minims of Succus Belladonnæ, and a grain of Opium, always produced their appropriate effects in a moderate degree upon this patient. Beginning with one drachm and a half, and rapidly increasiug the dose to one ounce, he took the latter quantity of Æthusa juice every second or third day for about a month. Effects were carefully looked for, but none were appreciable, either to the patient or to myself.

Observation 5.—Henry H—, æt. 17, a strong, active youth, troubled with frequent seminal emissions, took conium for some time, and a fluid ounce of the Succus always produced moderate coneism. On one occasion I gave him seven drachms of the Æthusa juice, and kept him sitting under my observation for two and a quarter hours. Just previously he had walked to my house, and the pulse was 86, the pupils slightly oscillant, and contracting to $\frac{1}{6}''$, and the tongue whitish and moist, with an acid secretion. After 45″ the pulse was 82, full and regular, as at first. The pupils and tongue were unchanged. After an hour and a half the pulse was 80 and otherwise unchanged. The pupils were now oscillating between $\frac{1}{6}''$ and $\frac{1}{7}''$. After two and a quarter hours the pulse was 74, regular, and of natural volume and force; the pupils were $\frac{1}{6}''$, dilating a little, as before the draught; the tongue unchanged, and the secretion acid still.

Two days afterwards nine drachms of the Æthusa juice were taken, the pulse being 86 and the pupils $\frac{1}{6}''$. After 45″ the pulse was 88, full and soft; the pupils fairly steady, and contracting to $\frac{1}{7}''$. After one hour the pulse was 80, otherwise unchanged; the pupils still $\frac{1}{7}''$. After two and a quarter hours pulse 72, regular, of initial volume and power; the pupils $\frac{1}{6}''$. The tongue remained unchanged throughout.

After an interval of eight days I gave him eleven drachms of

the Æthusa juice, two hours after a hearty meal, and watched for effects under the same conditions as before, the pulse being 84 and the pupils $\frac{1}{6}''$. After an hour and a quarter the pupils were unchanged and the pulse had risen to 82, but was not appreciably altered in volume or force. After two hours it was 80, and of initial volume and power, and the pupils were still $\frac{1}{6}''$. At the end of this time the patient passed f℥iiiss of urine (having emptied the bladder just before taking the dose), of sp. gr. 1032; excepting that it contained an excess of uric acid it was normal. Neither on this nor on any previous occasion did the patient himself experience any effect.

Observation 6.—George W—, æt. 17, a well-developed and moderately strong young man, the subject of epileptic aura. Upon this patient thirty minims Belladonna juice, one thirtieth of a grain of Atropia, four drachms of tincture of Henbane, six drachms of Succus Conii, and a mixture of four drachms each of tincture of Henbane and Succus Conii, severally produced their proper effects in a moderate degree. Failing to get benefit from either of these remedies or the bromides, I gave him the Æthusa juice, beginning with one-drachm doses every morning before breakfast for eight days, then three drachms increased to four drachms for six days more.

A fortnight afterwards in the evening I gave him a single dose of seven drachms, and he remained quiet for the next two hours. The pulse before the draught and after a walk to my house was 84, the pupils $\frac{1}{6}''$, the tongue clean, and wet with alkaline mucus. After 45″ the pulse was 85, unchanged. After two hours the pulse was 70, and of natural volume and force; the pupils and tongue remained unchanged throughout.

After an interval of six weeks the juice was again given in doses of one ounce, increased to one ounce and a half every other morning an hour before breakfast for a month. During the next nine days he took three doses, each consisting of two ounces of the thick juice. Effects were carefully watched for as often as the dose was increased, but both the patient and myself failed to observe any.

During the eight months which partly preceded and included the time of this treatment, the daily fits averaged 4·6, never exceeding 5, nor falling below 2. On the days when he took

the largest doses (two ounces) of Æthusa juice he had the full number (5) of fits, and on the intermediate days 4. This was probably due to the alcohol.

Observation 7.—E. B—, æt. 21, a strong healthy young man, in whom six drachms of Succus Conii produced slight coneism, took the Æthusa juice for a fortnight in doses increased from one ounce to two ounces every other morning before breakfast. The patient failed to experience any effect, nor could I detect any, excepting after one dose (an ounce and a half) a doubtful contraction of the pupil.

The following observations were made after a dose of two and a half ounces taken with as much water, the pulse being 78, pupils $\frac{1}{6}''$, and the tongue clean and moist. After taking the dose the patient strolled out for 45″, and then sat quietly during the rest of the time. At the end of an hour the pulse was 78, regular and of initial force and power, the pupils were slightly contracted (?), the tongue unchanged. After two and a quarter hours the pulse was 68, otherwise unchanged; the pupils slightly contracted, measuring nearly $\frac{1}{7}''$, the mouth unchanged.

Observation 8.—George L—, æt. 19, the subject of chronic spasm of the right arm, but otherwise healthy, and in whom six drachms of Succus Conii produced moderate effects, took two fluid ounces of the Æthusa juice, and three days afterwards four fluid ounces for a dose. On both occasions effects were carefully watched for during the three hours following each dose. Excepting slight somnolency, due to complete rest of mind and body during this interval, and to some extent probably to the alcohol, no effects were appreciable either to the patient or myself. This patient took other preparations of Æthusa. See Obs. 14, 16, and 18.

Tincture of the Fruit.—The fruit was gathered by myself in three different localities and in three different seasons. Tincture A was prepared from fruit gathered on 22nd of August, 1869, from plants growing in an exposed situation by ditch sides, between Sompting and the beach near Worthing. The fruit was nearly ripe, and the deeply keel-ridged carpels were parting and beginning to hang each on its own carpophore. The light green colour was nearly all replaced by a faint

brown, and the pair of brown caliper-like vittæ were conspicuous on the still paler commissure. The fruit was finely ground, and after prolonged maceration in a mixture of equal parts of rectified spirit and water, was finally exhausted by percolation. One part by weight of the fruit furnished four parts by measure of tincture. It was very bright and of a brownish-orange colour, and faint, but peculiar fatty odour and taste; mixed with water it became slightly opalescent. A fluid ounce yielded eleven grains of hard extract, 0·4 grain of which was reddish-brown, bitter oleo-resin. Rubbed with solution of potash and heated, no odour of conia was evolved.

Observation 9.—I took this tincture in doses varying from half a fluid drachm to six fluid drachms without experiencing any effect.

Observation 10.—The subject of Observation 3, a little girl, seven years old, took this tincture diluted with a little water, in doses increased from half a fluid drachm to half a fluid ounce. Excepting a slight rise of pulse at the end of an hour, due to the alcohol, no effects followed any dose.

On one occasion, just after she had walked a distance of two miles, and two hours after breakfast, the pulse being 120, and the pupils $\frac{1}{8}''$, I gave her six fluid drachms, and kept her sitting during the next two hours. After one hour the pulse was 98 and normal, and after two hours 96. The tongue and pupils were unchanged throughout, nor were any effects felt by the patient.

Observation 11.—Two fluid drachms of the tincture were evaporated over a water-bath at 110° Fahr. to fifteen minims, the oleo-resin being kept in solution by the addition of three minims of alcohol towards the close of the operation. The whole was then injected beneath the skin of a kitten two months old, and weighing about thirty ounces. The animal was so tranquil and sleepy for the two hours following the dose that I thought there was a slight hypnotic effect; there was no effect on the pupils, and the resp. was 40 and the pulse 160 throughout.

Observation 12.—A fluid ounce of the tincture was evaporated in the same way, and the residue injected beneath the skin

of another kitten four months old, and weighing three pounds. The animal was carefully watched for four hours, but no effects were observed. She was quiet and rather drowsy, but did not actually sleep during the whole of the time.

Tincture B was prepared from ripe fruit gathered September, 1870, from plants growing in a northern aspect, by the side of a low quick-set hedge, on the roadside near Monkton, Thanet. The same proportion of fruit was used, but the menstruum was rectified spirit two parts, water one part, acidulated with dilute sulphuric acid ($\frac{1}{40}$), and the maceration was prolonged for more than a year.

The tincture was nearly colourless, and contained so much oleo-resin that it became milky when mixed with water. The peculiar fatty odour and taste were proportionately stronger. A fluid ounce yielded ten grains of extract, 1·5 grain of which was reddish-brown oleo-resin. Rubbed with potash, the mixture, either cold or hot, failed to evolve any odour of conia.[1]

Observation 13.—I have taken this tincture in doses ranging from half a fluid drachm to a fluid ounce, without experiencing the slightest effects.

Observation 14.—George L— (see Observation 8) took, on one occasion, six fluid drachms of the tincture, and on another a fluid ounce. No effects followed either dose.

Tincture C.—This was prepared from the green unripe fruit, the bulk of which was reaching maturity. I collected it on the 25th August, 1873, from plants growing along a hedgerow on the northern side of an exposed turnip field, between Knole Park and the Wilderness, Sevenoaks. The fruit was macerated in enough rectified spirit to cover it, for three months, and was subsequently exhausted by dilute spirit, faintly acidulated with sulphuric acid. A tincture was thus obtained, a fluid ounce of which represented 165 grains of the green fruit, and yielded eighteen grains of hard extract, of which two grains were soft oleo-resin, of a brownish green colour, bitterish, and tasting and smelling of stale fish-oil. Potash merely intensified this odour.[1]

[1] "According to Walz, conine is probably contained in the ripe seeds of fool's parsley (*Æthusa cynapium*)." Watts's 'Dic. Chem.,' vol. ii, art. Conine, p. 2.

Observation 15.—I took a fluid ounce of this tincture, and experienced no effects.

Observation 16.—George L— (see Observations 8 and 14) took two fluid ounces of this tincture, and sat still for the three hours following. Excepting the slight stimulant effect of the alcohol, there were absolutely no results.

Observation 17.—A fluid ounce of the tincture was evaporated over a water-bath to about half a drachm, a few drops of alcohol being added towards the close to keep the oleo-resin in suspension, and the whole was injected beneath the skin of a kitten two months old, and weighing thirty ounces. Excepting that the animal was a little dull during the remainder of the day no effects were observed.

The Extract, prepared from the woody fibres left after expression of the juice.—In order to remove every trace of active matters from the plant, and to dissolve any that might have been deposited in a solid form, the marc was thoroughly exhausted with water slightly acidulated with sulphuric acid. The fluid was then percolated, and the residue freely washed with water. Twelve pints of light, yellowish-brown, opalescent fluid were thus obtained. It was spread over a wide area on flat dishes, and evaporated at a temperature never exceeding 110° Fahr. to the consistence of a soft extract, brown, of strong acid reaction, and containing much crystalline matter (chiefly sulphate of potash). It weighed 1050 grains.

The greater portion (750 grains) was nearly neutralized with milk of lime, and the mixture evaporated to dryness on a water-bath. The residue was now exhausted by boiling alcohol, and the alcoholic filtrate evaporated to five fluid drachms. It contained a large quantity of rich brown oleo-resin, and possessed an acid reaction. This was the fluid extract, and contained any cynapine that may have remained in the marc. On evaporating it to dryness and washing the residue with water the oleo-resin was separated. The aqueous solution left only a brown uncrystallizable extract on evaporation. The resin is similar to that obtained from the fruit.

Observation 18.—George L— (see Observations 8, 14, and

16) took the fluid extract in doses of half a drachm, one drachm, and two drachms; not the slightest effect followed either dose.

My observations at present extend no further. I may mention that no trace of gastric irritation or any other effect, immediate or subsequent, occurred in any case. The results, therefore, are merely negative. The slight contraction of the pupil observed in some cases was probably due to the stimulant effect of the alcohol in steadying an oscillating pupil.

The largest dose of the juice given was four ounces of the spirituous mixture, which is equivalent to three ounces of the fresh juice and to six ounces of the fresh herb, a quantity greater, I believe, than was taken, or assumed to have been taken, in any of the above-quoted cases of poisoning.

The maximum doses of the tincture of the *ripe* and *nearly ripe* fruit was a fluid ounce, equivalent, in either case, to ninety grains of the fruit.

The largest dose of the tincture of the *unripe* fruit was two fluid ounces, equivalent to more than 300 grains of the fruit.

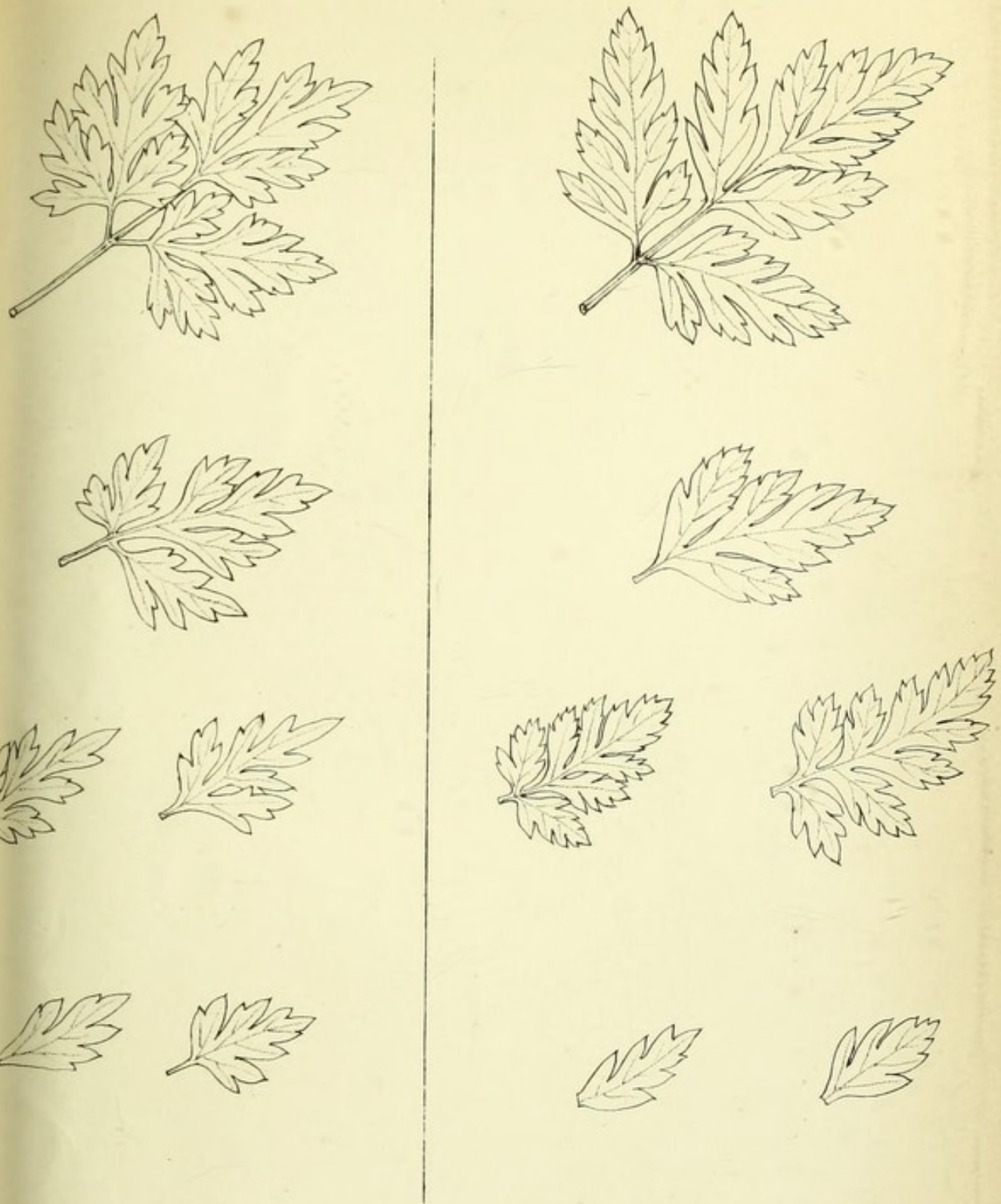
The Oleo-resin, bitter, soluble in alcohol, and then possessing a feeble and evanescent acridity of taste.

Observation 19.—Ten grains, obtained partly from the herb and partly from the fruit, were taken in solution by a healthy adult. No effects whatever followed.

In conclusion, I think it will be granted that these facts strongly corroborate the inference which I have deduced from my analysis of the so-called cases of Æthusa poisoning, namely, that the symptoms described are in some wrongly, and in the remainder most unsatisfactorily, attributed to the action of *Æthusa cynapium*. Taken alone, the facts which are included in Observations from 1 to 18 prove, I think conclusively, that *Æthusa cynapium* is a harmless plant; and, I may add, in reference to the footnotes at pp. 82 and 87, that it does not contain the least trace of conia. It may be objected that my observations on the *herb* have reference to only that of one season and locality; but, in answer to this, I may say that, from all we know of the constitution of plants, their activity is variable only in proportion to the quantity of water they con-

tain. In other words, that the quantity of active principle contained in a plant, grown under its native conditions, varies but slightly or not at all; but that the quantity contained in a given ounce of the expressed juice varies with the succulency of the plant, and the succulency will depend, of course, upon the season and locality. In reference to this question I have only to add that the herb employed in this investigation was grown in an exposed situation, and that its juice was of unusally high specific gravity.

Leaving now the question of poisonous properties, it only remains for me to say that I am unable to attribute any therapeutic influence to the plant. This, which is but the natural consequence of the foregoing conclusion, is disappointing. Still, I shall consider that my labours have been well rewarded, if it be found that I have established, what I am myself convinced is truth, namely, that *Æthusa cynapium* is a harmless plant.



Æthusa cynapium.

Conium maculatum.

Reprinted from 'St. Thomas's Hospital Reports,' Vol. X, 1880.]

A SECOND COMMUNICATION

ON

FOOL'S PARSLEY (*ÆTHUSA CYNAPIUM*).

By JOHN HARLEY, M.D.

It is often said that medicine can never become an exact science. It would be much nearer the truth to say, that such an education as the ordinary medical man receives, or such knowledge as he commonly acquires, can never lead him to be scientifically exact. His ordinary acquirements are too often but a cloak to his ignorance, and it follows that when he is called upon for scientific information he is apt to impart the crudest errors; the common practice ensures impunity, assertion takes the place of facts, and a didactic assurance carries more enforcement than knowledge.

These reflections seem harsh, but who can deny their truth? They are suggested on the present occasion by referring to my previous paper, in which I have given an analysis of all the published cases of reputed poisoning by fool's parsley. Here we witness, on the one hand, the animus of an ancient prejudice, and, on the other, a deplorable ignorance of the first object of these observations—the *Æthusa cynapium* itself. From this review, and from my own study of the plant, I was led to the unavoidable conclusion that it was perfectly harmless. Shall we say that the 300 years of horror, loathing,

and hate cast upon this now innocent little plant have at last purged it of its vices; or must we dejectedly confess that so much emotion has been so long and so ignorantly wasted? I think we are bound to make the confession. What a lesson to those who, with as much reason, erect their prejudices into altars whereat to sacrifice the best feelings of their nature!

The observations in my previous paper had reference to the juice prepared from Essex-grown plants of the year 1867, and to tinctures derived from fruits, both green and dry, grown in different localities in Sussex and Kent, and in three different seasons.

A notion prevails, I believe, to some extent, that locality and season have a great influence in developing or repressing the qualities of the poisonous umbelliferous plants, but I know of no fact which bears out that idea. It is said, for example, that hemlock is eaten as a salad in Russia. Well even in England, where the poisonous properties of hemlock are fully developed, the horse or the ox may browse upon the juicy plant to the extent of at least a pound of the young leaves without showing any of its physiological effects, and even man may eat an ounce of the herb without experiencing any appreciable degree of coneism. But we have yet to learn that hemlock is used in any part of the world as a salad, for there are the "greater" and the "lesser" hemlocks, and a reference to medical literature will show how easy it is to confuse them and how often this has been done.[1]

The lesser hemlock (*Æthusa cynapium*) might well be eaten as a salad in Russia or any other part of the world. That it has been so used seems to me very probable. Fool's parsley is a domestic plant. Like the house sparrow, it everywhere invades our homesteads, and it is rarely or never found in the wild uninhabited parts of the country. Nay more, it seems to have the same association with the Roman stations in this country as the *Smyrnium olusatrum* has with the Norman castles of a later age. Verulam, Richborough, and Thanet are notable instances, St. Albans especially, for there is no weed more common there than fool's parsley. I will leave the philologist to determine whether the prefix "fool's" is to be taken as indicative of a thing to be avoided, or a thing to be

[1] See my previous paper, p. 69, vol. iv, 'St. Thomas's Hosp. Rep.'

loved, as "my pretty fool," and will pass on to give further evidence of the harmlessness of the *Æthusa cynapium* for the benefit of those who may be still in doubt, or who are likely to be misled by those who have written more recently on the subject than myself. My previous paper seems very little known. Our eminent medical jurist, the late Dr. Taylor, indeed, has expressed himself as satisfied with the evidence which I have adduced; but when I turn to other writers on toxicology I find them transcribing the old story, and promulgating errors which I thought I had fully exposed seven years ago.

It is thus with von Boek in Ziemssen's 'Cyclopædia of Medicine,' who, unwittingly perhaps, adds to rather than diminishes from the error in quoting the following:—"In 1869 five members of one family became ill from eating a veal pie which had been flavoured with fool's parsley instead of ordinary parsley (Chèvallier)."[1]

"*Flavoured,*" merely flavoured! Oh, pernicious plant, worse than the worst, even aconite itself!

A foreigner may be excused for his ignorance of a few facts in English literature, but the same indulgence can scarcely be accorded to his English translator.[2] For the sake of contrast, the reader will perhaps allow me to transcribe the summary, almost entire, of the properties of fool's parsley as given in this most recent work on toxicology. The authors say "the leaves of fool's parsley have been eaten by mistake for common parsley, and the roots for parsneps. The plant may be known from true parsley by its producing, when rubbed, a nauseous odour. It is a narcotico-irritant poison. It is a poison to animals. Six ounces of the juice introduced into the stomach of a dog and secured by a ligature killed it in one hour. In the human subject it has caused death in one hour. Nausea, vomiting, stupor and insensibility, dysphagia, muscular tremblings, dilated pupils, and lockjaw have been observed." Then follow six illustrative cases, the evidence in which, amongst others, I have criticised and shown to be fallacious in my previous paper.

Botanists trouble themselves as little with the facts as do

[1] Ziemssen, vol. xvii, p. 829.

[2] Woodman and Tidy, 'Forensic Medicine and Toxicology,' London, 1877.

the toxicologists, and so we find the latest writers on medicinal plants[1] reiterating the stereotyped errors—amongst others this —"The leaves of fool's parsley when bruised emit a peculiar, disagreeable odour, which is altogether different from that of parsley." The authors previously quoted, in strict obedience to precedent, make the same statement, and I dare to assume that neither of these four men ever bruised fool's parsley themselves in order to appreciate its qualities. If they had done so they would have found that the odour of the bruised leaves is not unpleasant, inasmuch as it is faint, and resembles that of parsley itself. Again, in reference to Orfila's stupid experiments, can a man in his senses infer anything of the action of a medicine by forcing it into the stomach and then tying a string tightly round the gullet and its nerves? The only way to bring people who make such inferences to a sense of the realities of the situation would be to put them in it. In such a case, and apart altogether from the reputed poison, how many would survive the hour? It is surely time to expunge such glaring absurdities from scientific literature. Here my criticisms end, and I will now adduce my facts.

1. *Juice of the plant obtained before flowering.*—June 4th, 1874, between 5 and 6 p.m., I collected a few plants of *Æthusa cynapium* growing in an old-established walled garden, shaded by trees, within a stone's throw of St. Albans' Abbey, and sloping to the south. The day had been dry and hot. The plants varied from four inches to a foot high, were bushy and robust, and most of them just about throwing up a flowering stem. At night the roots were washed, and the plants placed in a deep vessel containing quarter of an inch of water. They were quite fresh in the morning, and between 9 and 10 a.m., that is, fifteen hours after they were gathered, they were crushed and pressed. To ensure success the roots were crushed separately, they evolved more of the pleasant carroty flavour than the herb. The herb proved to be very succulent, as Mr. Walter Hemingway's statement will show:

[1] Bentley and Trimen, vol. ii, p. 124, 1880.

	lbs.	oz.
Gross weight of herb . . .	1	15½
Weight of expressed juice . .	1	7¼
„ „ marc	0	7
	1	14¼
Loss	0	1¼
	1	15½

The expressed juice measured 23 oz., and it was mixed with 7 oz. 6 drachms of rectified spirit. The turbid mixture was not filtered. After subsidence of the solid matter the juice was brightly clear, of the colour of pale sherry, and a pleasant taste. Five hundred grain measures evaporated to dryness on a water bath yielded 20·3 gr. of varnish-like, orange-brown extract.

2. *Juice obtained from the plants in green fruit.*—The remainder of the plants in my friend's (Mr. Edward Beal's) garden were allowed to grow undisturbed, and they finally attained a great size. On the 25th of July I pulled one of the finest of these plants (about three feet high) out of the ground, and during the afternoon chewed the washed root. It had a sweet taste, with a pleasant flavour resembling both carrot and parsley; it was tough and woody, and harder than pine wood to chew. I experienced no effects.

In the evening of the 7th August the rest of the plants were dug up and sent to me entire. I received and examined them the same night. They were very finely grown, and heavy with fully-formed, green, sweet fruit. Most of the plants were over two and a half feet high. Many had a dozen umbels. One plant was four and a half feet high, had eleven primary branches, and 173 umbels, and the stem at the base was half an inch in diameter.

The plants were crushed and subjected to strong pressure early next morning. The following is Mr. Walter Hemingway's statement:

	lbs.	oz.	
Weight of Æthusa cynapium .	12	10	
„ „ juice expressed . .	5	1	=78 fluid ounces.
	7	9	
„ „ marc	6	15	
Loss	0	10	
	7	9	

The 78 fluid ounces of expressed juice were mixed with one third of its bulk (19 fluid ounces) of rectified spirit, making a total of 97 fluid ounces. The turbid mixture was not filtered. It was a very dark brownish-green, and after the subsidence of the solid matter the bright supernatant fluid was of a rich reddish-brown colour, darker than taraxacum juice, which, though free from bitterness, it resembled in taste. Five hundred grain measures, evaporated to dryness on a water bath, yielded 53 grains of dark, rather charred extract, for my water bath had become dry.

3. *Observations on the juices of the immature and mature plants.*—Being thus provided with carefully prepared juices of the young plant in its most succulent condition, and of the same generation of plants in their fully matured condition, I exhausted my supply upon four patients, one a little girl six years old, who took them in doses ranging from 2 drachms to 2 ounces; myself, who took them in quantities ranging from 2 to 4 fluid ounces; and two other adults, who were the subjects of spasmodic torticollis. These two took one or other of the juices in doses ranging from 1 to 8 fluid ounces. Effects were carefully looked for, but there were absolutely none in either case after any one of the doses.

Further detail is superfluous, and I may say in conclusion that the *Æthusa cynapium* of Sussex, Kent, Surrey, Essex, and Hertfordshire is not only absolutely free from the noxious properties attributed to it, but that it is pleasant all, to sight, smell, and taste, and, in the absence of the more fragrant and succulent plants, might well be used as a potherb or a salad. If any one should think differently of the plant of his locality, I will be ready to indulge his scruples, to test the matter with him, and satisfy him, as I have no doubt I shall be able to do; that my conclusions are independent both of locality and season; and that the only influence which these conditions have on Fool's Parsley, as on Hemlock, is to increase or diminish its succulency.

ON THE USE OF

BELLADONNA IN ENTERIC FEVER.

By JOHN HARLEY, M.D. Lond., F.R.C.P.

What advantages are to be expected from the use of belladonna in enteric fever? is the question which presents itself at the outset of this inquiry, and suggests the need of a proper theory of the action of the drug. This primary question resolves itself into two others, viz. 1, the nature of enteric fever; and, 2, the special action of belladonna in the body. A brief consideration of these will therefore be a proper, if not an altogether necessary, introduction to the main subject.

As to the nature of enteric fever. It will be sufficient for our present purpose to regard it as a general enteritis, accompanied by sympathetic irritation of the lacteal glands and spleen, and commonly associated with more or less pulmonary inflammation —a condition of congestion of the internal viscera,—of dilated blood-vessels and retardation of the blood current amounting at certain points to actual stasis.

As to the action of belladonna. The effects of moderate and oft-repeated doses are as follows:—1, they have a hypnotic and sedative action on the brain and spinal cord respectively; and, 2, a powerful stimulant action on the sympathetic nervous system, as may be demonstrated by the following experiment:—A dog, susceptible of the hypnotic influence of opium, is narcotised by a sufficient dose of morphia for the space of three or four hours. The

respiration and pulse, which have sunk to a uniform level as soon as narcotism supervened, will be maintained, the first at 14 to 16, and the latter from 65 to 75, a minute, the pulse manifesting a very regular respiratory undulation, rising to 75 towards the end of inspiration, and falling to 65 at the end of expiration. The pupils will be contracted to about $\frac{1}{7}$th. If now the fraction of a grain ($\frac{1}{96}$th) of atropia be admitted under the skin during any period of the narcotic stage, remarkable effects are rapidly developed. The finger which could previously feel the apex stroke of the heart with difficulty, now clearly distinguishes a growing excitement, which in the course of a few minutes becomes evident to the eye as well. A quarter of an hour after the injection, the pulse is nearly trebled in frequency. The cardiac excitement progressively increases, and at the end of three quarters of an hour the heart is seen vibrating against the chest-wall, beating regularly 300 times in the minute, being an acceleration of 234 beats for this brief period. This, the maximum acceleration, is sustained for a while, and the rate then slowly declines, but at the end of four hours the pulse is still accelerated some 24 beats beyond the initial rate. The pupils mean time are widely dilated. Further and in respect of the hypnotic influence of belladonna, the same effects result if the atropia be given at a time when the narcotism has passed off and the animal is readily awakened from sleep; but in addition to the stimulant effects on the sympathetic ganglia above described, the animal again lapses into a state of narcotism. Even when the dose of morphia is double, and that of atropia reduced to half, the same effects are observed. Indeed, as I have shown, opium and belladonna both intensify and prolong each other's effects; and since opium as a means of checking excessive diarrhœa was in many of the cases a necessary adjunct to the belladonna treatment, it is proper that I should call attention to the combined operation of the two drugs. It will be understood, therefore, that the action of belladonna on the body is the same whether it be given alone or in combination with opium, but that in the latter case it is somewhat intensified.

Looking, therefore, to the effects of belladonna in dilating the pupils and exciting the heart, we conclude that the drug is

[1] 'Old Veget. Neurotics,' pp. 107, 275.

a direct and powerful stimulant to the sympathetic nervous system.

Let us now inquire what are its effects on the blood-vessels. If we observe the small arteries and capillaries during the operation of moderate doses of belladonna, we shall find that they are maintained for hours in a tonic and slightly contracted condition. The blood is equally distributed, and the circulation in any given part is so tight and rapid, that it really contains a little less blood than when in a quiescent state, and the tissue is consequently a little paler, but the quantity that passes through it in a given time is greatly increased. It is to be expected that a drug which is capable of producing such intense excitement will, if given in excessive doses (and these will be still as to quantity very minute), produce exhaustion. This is actually the case; dilatation of the minute blood-vessels and stasis of the blood being the effects of improper doses. As these observations on the use of belladonna in enteric fever were made about seven years ago, and before belladonna juice was admitted into the Pharmacopœia, I may mention that the succus employed was prepared by Messrs. Jacob Bell & Co., in the manner and proportions since prescribed in the Pharmacopœia. The following were the effects of ℥xxx (a dose given to many of the patients whose cases are narrated below), as noted in six healthy adults, male and female. Belladonna action was fully developed in all within an hour, and completed as far as could be determined by any appreciable effects at the end of the second hour. The pulse in one was accelerated only 10 beats; in another, 20; in a third, 26; in two others, 40 beats; and in the sixth (a youth of twenty), the cardiac systoles were more than doubled, the pulse rising from 60 to 140 beats. No effect on the respiratory movements were observable in any. The individual in whom the acceleration of the pulse amounted to 80, did not throughout the 45 minutes during which this the maximum acceleration continued, manifest the slightest disturbance of the breathing. The respiration never exceeded 18; and at the time when the cardiac excitement first reached its acme and afterwards the inspirations numbered 15 or 16, and were natural and easy.

When the patient is taking thirty minims of belladonna juice every four hours for days together, moderate or excessive symptoms (of which active delirium is the chief) are developed ac-

cording to the age or idiosyncrasy of the patient; and it is never necessary to give this full dose oftener than every six hours. In some cases I have found it necessary to diminish the dose on account of talkative delirium which had evidently been induced by the belladonna; and, as a rule, I find that ℥xv of the succus given every four or six hours is quite sufficient to sustain that moderate atropism which is beneficial. When deliriuin has been present, I have never found this dose increase it, but rather the reverse.

In enteric as in scarlet fever, severe congestion of the kidneys, and attendant albuminuria are not uncommon events. For the prevention or relief of this condition belladonna is the appropriate remedy, for I have shown that the whole of the atropia admitted into the body is eliminated unchanged by the kidneys. If, therefore, the quantity of atropia be not excessive, it follows that an active circulation is maintained in these organs during the time they are engaged in its elimination.

With these prefatory remarks I will now introduce my cases, and will afterwards review the particular effects of the drug, and endeavour to draw some general conclusions as to its use in enteric fever.

CASE 1.—*A severe case with much and persistent diarrhœa from the first; convalescence began on the thirty-eighth day.*

Thomas G—, æt. 19. Had been ill in bed eight days before admission with fever and diarrhœa, six or seven loose stools a day.

Treatment.—He took ℥xxx Succi Belladonnæ sextis horis from the ninth to the thirty-fifth day, and occasional doses of opium.

Progress.—During the second week the diarrhœa was profuse and there was slight nocturnal delirium. On the fifteenth day there was vomiting. On the thirty-eighth the stools became solid and natural, and convalescence commenced, and was effected without interruption.

9th day.—℥xxx *Succi Belladonnæ, sextis horis.* Restlessness; slight delirium at night; several loose stools; no rash; tongue fissurally ulcerated, moist. Temperature 104.° Pulse 112. Such was the condition before the medicine was given.

10th.—♏v *Tincturæ opii* with each dose of Belladonna. Much diarrhœa last night; tongue dryish. T. 100·4°. P. 84.

11th.—Gr. x *Pilulæ saponis co.*=gr. ij *Pulveris opii.* Slept after the additional opium; great dryness of the mouth and thirst; belly retracted, one rose spot, one loose stool. T. 100°. P. 100.

12th.—Two loose stools last night; skin and tongue dry. T. 102·6°. P. 80.

13th.—Two loose stools last night; tongue clean and moist, cracks contracting; pupils $\frac{1}{5}$; brighter, and said he was better and hungry. T. 99·2°. P. 96.

14th.—♏xx *Tincturæ opii* as an enema. Several loose stools. T. 100°. P. 92.

15th.—Gr. i *Pulveris opii.* Bowels quiet; tongue dry. T. 100°. P. 96.

Evening.—Much abdominal pain; vomiting. T. 100°. P. 112.

16th.—One stool; tongue dry down the centre, with deeply ulcerated fissures; mind tranquil. T. 100·4°. P. 84.

Evening.—T. 101·2°. P. 84.

17th.—Bowels quiet; felt comfortable. T. 100·4°. P. 84.

18th.—*Pulveris opii* gr. i, *sextis horis.* Bowels loose last night. T. 100°. P. 84.

19th.—Bowels quiet. T. 99·2°. P. 80.

20th.—Two loose stools. T. 99·2°. P. 78.

21st.—Bowels quiet; asked for food; tongue moist. T. 99°. P. 72.

22nd.—Omitted the opium. One loose stool. T. 99·4°. P. 72.

23rd.—Two loose stools last night; tongue clean, fissured. T. 99·4°. P. 72.

24th.—No action of the bowels. T. 99°. P. 84.

25th.—No action of the bowels; abdomen thin and tense; a little uneasy in breathing; tongue moist and clean; the cracks healing. T. 99·2°. P. 84.

26th.—Bowels open twice; abdomen softer, still a little uneasy in breathing; tongue clean and wet. T. 97·4°. P. 72.

27th.—Two loose stools. T. 98·2°. P. 80.

28th.—Two loose stools. T. 98·6°. P. 72.

29th.—*Pulveris opii* gr. i, *sextis horis.* Four loose stools since yesterday; tongue clean and moist; cracks nearly healed; great hunger. Temperature 98·8°. Pulse 92.

30th.—Omitted the opium. Two loose stools. T. 99.° P. 72.
31st.—*Enema opii* = ℥xx *Tincturæ opii.* Six loose stools; appeared bright and well. T. 97·8°. P. 76.
32nd.—No action of the bowels. T. 99·2°. P. 76.
33rd.—No action of the bowels. T. 98·8°. P. 72.
34th.—Two moderately loose yellow stools. T. 99°. P. 104.
35th.—*Haustus cinchonæ* in place of the belladonna. No action of the bowels; tongue and abdomen natural, and the patient was bright and comfortable.

CASE 2.—*A severe case with prostration; the treatment adopted in the mid-career of the disease. It was probably the thirty-fourth day before convalescence began.*

Catherine P—, æt. 11, admitted August 11th, duration of illness uncertain, chief symptoms fever and diarrhœa.

Treatment.—She took ℥xv Succi belladonnæ from the first to the eighteenth day of her sojourn in the hospital, and from the second day took six ounces of wine daily.

Progress.—Excessive prostration was the chief feature of this case. Belladonna was given from the fourteenth (?) to the thirty-third day. Bronchitis threatened on the tenth day of treatment; the prostration was greatest on the twelfth. From this time she began to improve, and on the eighteenth day of treatment convalescence was established and recovery was rapid.

August 11th.—℥xv *Succi belladonnæ, quartis horis.* Hot poultice to the abdomen. Prostrate, apathetic, pale, and emaciated; respiration frequent, with sighing and moaning; teeth dirty with sordes; tongue dry, brown; abdomen full and hard; bowels loose; sickness. Temperature 104°. Pulse 128.
12th.—Six ounces of wine. Great prostration. T. 104°. P. 130.
13th.—Retention of urine; bowels loose. T. 104°. P. 130.
14th.—Mouth dry and black with sordes; bowels quiet. T. 101°. P. 120.
15th.—No action of the bowels. T. 101·4°. P. 120.
16th.—No action of the bowels; condition much the same. T. 100·4°. P. 108.

17th.—Two loose stools. T. 102·2°. P. 108.

18th.—Two loose stools. T. 100·2°. P. 120.

19th.—Abdomen soft; sordes moistening. T. 98°. P. 116.

20th.—Mucous râles over the bases of the lungs; restlessness. T. 98·2°. P. 120.

21st.—Very apathetic still; mouth still black with sordes; bowels not open. T. 101·2°. P. 116.

22nd.—Prostration extreme, nearly unconscious, slipping down in the bed, and rolling the head from side to side. T. 107°. P. 112.

23rd.—Less restlessness. T. 98·6°. P. 120.

24th.—Bowels open once, the first time for five days, stool solid; sleep less disturbed. T. 98·6°. P. 120.

25th.—Consciousness returning; gave an answer for the first time; tongue moistening; sordes disappearing. T. 98°. P. 116.

26th.—Improving. T. 98·2°. P. 116.

27-8th.—℥j *Olei ricini* each day. Much improved; bowels had not acted for four days. T. 98°. P. 116.

29th.—Substituted *Haustus cinchonæ* for the belladonna. The oil acted to-day, giving two stools, the first nearly solid, the second rather loose; greatly improved; lay on the side, looking bright and cheerful; mouth clean and moist. Temperature 98·2°. Pulse 88.

Case 3.—*A moderate case and early convalescence.*

Esther L—, æt. 16. Had been ill seven days before admission with sickness, diarrhœa, and abdominal pain.

Treatment.—From the seventh to the twelfth day she took ♏x Acidi sulphurici diluti cum ♏v Tincturæ opii; thence forward to the twenty-fifth day Succi belladonnæ ♏xv, cum Tincturæ opii ♏v, quartis horis.

Progress.—Nervous symptoms were absent in this case. Improvement began on the twelfth day, and continued without interruption until the twelfth day of the belladonna, the twenty-fourth of the disease, when convalescence was established.

8th day.—*Haustus acidi sulphurici et opii.* Tongue dry and fissured; abdomen tense and painful; three loose stools; rose rash. T. 103°. P. 120.

12th.—ℳxx *Tincturæ belladonnæ*, ℳv *Tincturæ opii, quartis horis.* Continued in the same state, the temperature varying from 103° to 102°; and the pulse from 102 to 104.

13-17th.—Tongue still dry; voice husky; abdomen natural; rash faded; one loose stool every day. Temperature varied from 102·3° to 99°; and the pulse from 104 to 96.

19th.—Improved; tongue dryish, the cracks healing; somnolency; no action of the bowels the last two days. T. 99°. P. 84.

22nd.—One moderate, consistent, yellow stool; tongue moist, clean, and pink; bright and cheerful. T. 98°. P. 80.

24th.—Belladonna and opium discontinued. Tongue and abdomen natural; convalescent. Temperature 98°. Pulse 80.

CASE 4.—*A mild case, convalescence on the twenty-fifth day.*

George W—, aged 22. Had been ill fourteen days before admission with headache, anorexia, and fever.

Treatment.—He took ℳxxx Succi Belladonnæ, quartis horis, from the seventeenth to the thirtieth day.

Progress.—The symptoms declined in severity from the day of admission.

14th day.—*Haustus acidi sulphurici et opii.* Bowels loose; tongue moist, with red edges. T. 102°. P. 110.

17th.—ℳxxx *Succi belladonnæ, quartis horis.* Continued in the same state; numerous rose spots and bluish blotches; bowels loose. T. 100°. P. 90.

18th.—Bowels quiet. T. 98°. P. 72.

19th.—Fresh rose spots; bowels quiet. T. 98°. P. 72.

20th.—Bowels quiet. T. 97·8°. P. 60.

21st.—Bowels quiet. T. 98·2°. P. 72.

22nd.—Bowels quiet. T. 98·6°. P. 60.

23rd to 29th.—Continued to improve; motions become consistent; convalescence. During these days the temperature ranged from 98·6° to 97·6°, and the pulse from 80 to 60.

30th.—Belladonna discontinued. The patient left his bed.

CASE 5.—*A moderately severe case, hæmorrhage on the eleventh, convalescence on the twenty-fourth day.*

Esther P—, aged 20. Had been ill a week before admission with headache and looseness of the bowels.

Treatment.—She took ℥xxx Succi belladonnæ, quartis horis, from the seventh to the eleventh and from the fourteenth to the twenty-second day.

Progress.—There was constipation from the seventh to the eleventh day, when there was hæmorrhage. Convalescence began on the eighteenth day of the disease. With an interruption of two and a half days the belladonna was given during sixteen days.

7th day.—℥xxx *Succi belladonnæ, quartis horis.* Abdomen full and hard; several rose spots; tongue dry and cracked; restless; delirium at night. T. 103°. P. 120.

8th.—Bowels quiet. T. 102·6°. P. 120.

9th.—Bowels quiet. T. 103°. P. 120.

10th.—Poultice to the abdomen. Bowels not acted since admission; abdomen tense; tongue dry and brown. T. 101·6°. P. 108.

11th.—Substituted *Haustus terebinthinæ* in the evening for the belladonna, and gave ℥xx *Tincturæ opii* as an enema. Bowels quiet all day, but in the evening there was hæmorrhage, estimated at half a pint. T. 102·2°. P. 132.

12th.—Bowels quiet. T. 103°. P. 124.

13th.—A loose stool, but no trace of blood. T. 99·1°. P. 116.

14th.—Omitted the turpentine and resumed the *belladonna.* Bowels open once; tongue moist and cleaning. T. 99·4°. P. 112.

15th.—Bowels open once. T. 100°. P. 108.

16th.—No action of the bowels. T. 98°. P. 96.

17th.—No action of the bowels; tongue natural. T. 98·2°. P. 88.

18th to 23rd.—Discontinued the belladonna on the twenty-second day. Comfortable, cheerful, and very hungry; the temperature and pulse retaining their normal character; convalescence was rapid.

CASE 6.—*An ordinary case with early prostration. Convalescence on the twenty-second day.*

Robert H—, aged 63. Had been ill three days before admission with general pains, much thirst, and looseness of the bowels.

Treatment.—He took ℥xxx Succi belladonnæ, quartis horis, from the fourth to the twentieth day.

Progress.—Diarrhœa ceased on the twelfth day of treatment. There was much complaint of a bitter taste as long as the belladonna was continued.

4th day.—℥xxx *Succi belladonnæ, quartis horis.* Tongue dry and brown; great prostration; three loose stools. T. 100·8°. P. 84.

5th.—T. 100·8°. P. 84.

6th.—Tongue unchanged; six loose stools in the night. T. 99·2°. P. 84.

7th.—Bowels quiet. T. 100·8°. P. 76.

8th.—Tongue moistening at the edges; no action of the bowels; said he was much better. T. 98·6°. P. 76.

9th.—Tongue still dry; bowels open once. T. 99°. P. 72.

10th.—Five loose stools last night. T. 99°. P. 72.

11th.—Tongue dryish and cracked in the centre, moist and clean elsewhere; abdomen natural; said he was very comfortable. T. 100°. P. 80.

12th.—Bowels loose. T. 98·4°. P. 84.

13th.—℥xx *Tincturæ opii*, as an enema. Tongue quite dry; several loose stools. T. 99°. P. 108.

14th.—Bowels quiet. T. 99·4°. P. 72.

15th.—Bowels quiet. T. 99·6°. P. 72.

16th.—Bowels quiet. T. 99·8°. P. 84.

17th.—Improving; the cause of the increased pyrexia on this and the following day was not obvious. T. 103·6°. P. 120.

18th.—T. 103·6°. P. 120.

19th.—T. 98·2°. P. 72.

20th.—Discontinued the belladonna. Much improved; tongue clean. T. 98·2°. P. 72.

21st.—Bowels had acted to-day, the first time for five days, stool solid; convalescence was uninterrupted from this date. T. 98·2°. P. 72.

22-26th.—During these days the temperature ranged from 98·6° to 98·2°; and the pulse from 80 to 48.

CASE 7.—*A severe case. Hæmorrhage on the fifteenth, eighteenth, and nineteenth days. Convalescence began on the twenty-seventh day.*

John G—, æt. 24. Had been ill seven days before admission with headache, continued diarrhœa, and general pains.

Treatment.—He took ℥xxx Succi belladonnæ cum tincturæ opii, ℥v sextis horis, till the evening of the twentieth, when, on account of the hæmorrhage, turpentine was prescribed instead.

Progress.—Insomnia; restlessness and moderate nocturnal delirium marked the earlier days of the disease. Great relief followed the hæmorrhage on the fifteenth day. An increase of pyrexia attended the second bleeding on the eighteenth day. An eruption of sudamina appeared on the twentieth, and thenceforward the progress towards recovery was rapid.

8th day.—℥xxx *Succi belladonnæ et* ℥v *Tincturæ opii, sextis horis,* in addition ℥xv *Tincturæ opii* to-night. Tongue dry; abdomen rather full and hard; very restless; insomnia; rash abundant. T. 104·4°. P. 120.

9th.—Several loose stools. T. 104·4°. P. 96.

10th.—Rash very copious and large. T. 103·6°. P. 108.

11th.—℥xx *Tincturæ opii* as an enema. Diarrhœa continued. T. 104·2°. P. 120.

12th.—Bowels still loose; tongue covered with yellow fur; insomnia.

13th.—Repeat the *Enema opii.* Bowels still loose. T. 103·2°. P. 96.

14th.—Sedative = ℥xv *Tincturæ opii.* Slight delirium; abdomen tense; much sweating; tremor of the lips and hands; numerous fresh spots; two loose stools. T. 102·4°. P. 92.

Evening.—Continued restless all day. T. 102·2°. P. 130.

15th.—Four loose stools, each with blood; amounting in all to a considerable quantity. Fresh spots. T. 102°. P. 96.

Evening.—Substituted turpentine draught for the belladonna; *Enema opii.* Tongue moist; one stool with a tinge of blood; skin cool. T. 100°. P. 80.

16th.—Bowels not open during the previous night, but thrice to-day, without blood; tongue moist and red. T. 102°. P. 96.

17th.—Brandy ℥iij. Weaker, but comfortable; tongue moist. T. 101·4°. P. 92.

18th.—Bowels open twice; about half a pint of dark blood in last stool. T. 104°. P. 100.

19th.—Two loose stools, tinged with blood. T. 102·6°. P. 108.

20th.—*Enema opii.* Four loose stools, with slight tinge of blood; a few new spots; eruption of sudamina; tongue moist and clean; slept well; abdomen rather full. T. 102·8°. P. 104.

21st.—Bowels open once; no blood. T. 102°. P. 100.

22nd.—Three loose stools. T. 101·4°. P. 104.

23rd.—One stool, more consistent. T. 100·8°. P. 92.

24th.—One dark bilious, more consistent stool to-day; tongue moist and nearly clean; comfortable and cheerful; convalescence was uninterrupted. T. 101·2°. P. 92.

CASE 8.—*A moderately severe case, with early prostration. Convalescence began on the twentieth day.*

James M—, æt. 6. He had been ill seven days before admission, with fever and diarrhœa.

Treatment.—ɱxv Succi belladonnæ, sextis horis, from the eighth to the twenty-seventh day.

Progress.—There was great pallor and apathy throughout. The diarrhœa and prostration were relieved on the eighth day of treatment. On the twentieth day there was hunger. From this date the motions became consistent, and on the twenty-seventh day the evacuations were natural.

8th day.—Restless; pallid; tongue dry and brown; three loose stools. T. 103°. P. 130.

9th.—ɱxv *Succi belladonnæ, sextis horis.* A few rose spots. T. 103°. P. 130.

10th to 16th.—Prostration with restlessness, and from two to four loose stools a day. T. 103° to 100·5°. P. 130 to 120.

17th.—Progress gradual; now much improved; sat up in bed; tongue clean and moistish; one loose stool a day since the fifteenth. T. 99·2°. P. 120.

18th.—T. 103·2°. P. 120.

19th.—Intelligence returned; tongue clean and moist. T. 97·8°. P. 100.

20th.—Convalescing. Only one stool during the last two days. T. 98°. P. 108.

23rd.—Still improving. One moderately loose stool. T. 98°. P. 96.

24th.—One consistent stool. T. 97·2°. P. 100.

26th.—Belladonna discontinued. A natural stool; convalescence rapidly completed from this date. T. 97·2°. P. 96.

Case 9.—*The abdominal symptoms were severe during the second week, but convalescence was unusually early, beginning on the eighteenth day and continuing without interruption.*

Alice H—, æt. 20. Had been ill nine days with fever and diarrhœa before admission.

Treatment.—She took ℥xxx Succi belladonnæ, quartis horis, from the eleventh to the twenty-third day, and on the eleventh day an opiate enema was required.

Progress.—Beyond a little restlessness and nervousness during the first week, there were no nervous symptoms. Convalescence began on the eighteenth day.

10th day.—Abdomen full and tender; no decided rash; three loose stools; tongue dry anteriorly. T. 104°. P. 120.

11th.—℥xxx *Succi belladonnæ, quartis horis;* xx *Tincturæ opii* as an enema. Several loose stools; respiration nervous. T. 104°. P. 120.

12th.—Tongue glazed; face flushed. T. 103·4°. P. 100.

13th.—Three loose stools. T. 105°. P. 92.

14th.—Abdomen still full and rather tense. T. 99°. P. 80.

15th.—One loose stool to-day; belly soft. T. 98·4°. P. 88.

16th.—Two loose stools to-day. T. 98°. P. 80.

17th.—One stool; tongue clean and moist; convalescing. T. 98°. P. 80.

18th to 23rd.—Discontinued the belladonna. During these days convalescence was uninterrupted; there was no action of the bowels for the first three days, but one natural stool each day since. Now bright and hungry. T. 99° to 98·2°. P. 96 to 68.

CASE 10. — *A case of moderate severity, accompanied by prostration and catarrhal symptoms with sweating. Convalescence began on the twenty-seventh day.*

John M—, æt. 18, had been ill thirteen days before admission, with headache, anorexia, and diarrhœa.

Treatment.—He took ℥xxx Succi belladonnæ, quartis horis, from the fourteenth to the thirty-first day, combined with ℥v Tincturæ Opii, from the nineteenth to the twenty-third day.

Progress.—Profuse sweating set in on the fourth day of the belladonna treatment, and continued with intermissions of a few hours during the next nine days. There was general relief on the tenth day of treatment.

14th day.—*Haustus acidi sulphurici et opii.* Very prostrate and apathetic; tongue dry and glazed; bowels loose. T. 103°. P. 96.

15th.—℥xxx *Succi belladonnæ, quartis horis.* Omit the former medicine. T. 103°. P. 100 before the belladonna.

16-17th.—Continued in the same general condition. T. 100·4°. P. 72.

18th.—Tracheal cough; considerable sweating. T. 97·6°. P. 56.

19th.—Add ℥vi *Tincturæ opii* to each dose of belladonna. Slight bronchitis; bowels still loose. T. 102°. P. 76.

20th.—Great prostration; bowels moderately loose. T. 101·6°. P. 72.

21st.—Apathetic; tongue dry, with wide moist edges. T. 101·2°. P. 72.

22nd.—T. 100°. P. 72.

23rd.—Discontinued the opium and took ℥xxx *Succi belladonnæ* alone every six hours. Improved; drowsy; bathed in sweat; respiration 12; abdomen natural; no action of bowels for two days. T. 93·6°. P. 56 to 43.

24th.—One loose stool. T. 101·4°. P. 88.

25th.—T. 99·2°. P. 52.

26th.—Much brighter; tongue clean and moist. T. 98·2°. P. 60.

27th.—"Felt very well." Profuse sweating; tongue clean and moistish. T. 98°. P. 64.

28th.—A solid stool. Hunger. T. 101°. P. 80.

29th.—A solid stool. Hunger. T. 99·8°. P. 84.

30th.—A solid stool. Hunger; sweating continued. T. 99·8°. P. 84.

31st.—Belladonna discontinued. Convalesced from day to day; stools natural. To-day took solid food; the sweating ceased, leaving the skin naturally moist. T. 100° to 98·4°. P. 68 to 54.

CASE 11.—*A severe case during the first fortnight, but convalescence was rapid, beginning on the twentieth day.*

Marianne H—, æt. 19. Had been ill several days before admission with fever and diarrhœa.

Treatment.—She took ℥xx Succi belladonnæ cum ℥v Tincturæ opii from the eighth to the twenty-second day.

Progress.—There were diarrhœa, much stupor, and quiet delirium until the fourteenth day, at which date bile reappeared in the stools, and desire for food returned.

8th day.—*Succi belladonnæ* ℥xx, *Tincturæ opii* ℥v, *quartis horis.* Delirious; tongue dry; abdomen tender; rose rash; four loose stools. T. 104°. P. 125.

13th.—Had continued in much the same condition; fresh eruption; moderate diarrhœa; abdomen now tense and tender; tongue dry, glazed, and contracted. T. 104° to 101·5°. P. 120 to 98.

14th.—Four loose stools; a dry, tracheal cough. T. 100°. P. 98.

15th.—Much improved; two loose stools; abdomen natural; tongue moistening, and epithelium separating. Asked for an egg. T. 100°. P. 95.

18th.—Continued improvement; one loose, bright yellow stool each day; tongue moist at edges. T. 98°. P. 80.

20th.—Convalescing. T. 97°. P. 72.

32nd.—Omit the mixture. Tongue natural; two yellow semi-solid stools. Rapid convalescence. T. 98°. P. 80.

CASE 12.—*A severe case, complicated with broncho-pneumonia. Convalescence began on the thirty-second day of her sojourn in the hospital, probably about the fortieth day of the disease.*

Emily C—, æt. 5, admitted, on an unascertained day of fever, with great pyrexia; pulse 132, tongue dry, abdomen full, profuse diarrhœa, and indications of general broncho-pneumonia moderately developed.

Treatment.—For the first sixteen days she took ɱxxx Succi belladonnæ, quartis horis, with occasional doses of senega and ammonia; and the next seven days the same dose of belladonna every six hours. Poultices of linseed and mustard were continually applied to the chest during the prevalence of the bronchial symptoms.

Progress.—On the twelfth day after admission there was fully developed bronchitis, diffused through both lungs, with harsh crepitant inspiration and a troublesome dry cough. During the next few days there was very copious frothy expectoration. On the seventeenth day there was great amelioration, the cough and expectoration were much diminished, the pulse was 98, and the tongue clean and moist. The improvement continued over the twenty-first day, when the pulse was 92. A slight increase of pyrexia followed, which gradually declined, and on the thirty-second day after her admission she was convalescent. The enteric symptoms were moderate, the stools continued loose and ochre-coloured to the twenty-third day, but the motions never exceeded three in the twenty-four hours.

The average daily rate of the pulse was 109. After the first four doses of the belladonna it was reduced to 100, and at the height of the pyrexia it numbered during two days (the twelfth and thirteenth) 132.

On the twenty-sixth day the tongue was clean and moist, and the motions hard. The pupils were widely dilated throughout, but there was neither delirium nor insomnia.

CASE 13.—*A case of moderate severity and early convalescence.*

Charlotte Y—, æt. 12, admitted on the seventh day of fever, suffering general pains; bowels loose; face flushed; dorsal decubitus; moderate pyrexia; pulse 120; tongue moist, coated, cracked at the centre.

Treatment.—She took ℥xxx Succi belladonnæ, sextis horis, from the seventh to the fifteenth day, and ℥xv, sextis horis, from the fifteenth to the twenty-first day.

Progress.—The condition was typhous[1] for five days after admission; the tongue was cracked; the abdomen moderately distended, and there was moderate diarrhœa. On the evening of the twelfth day, the rose spots were faded, and she passed, in a stool chiefly fluid, a small quantity of soft almost formed fæcal matter of natural colour. From this time there was no diarrhœa. On the fourteenth day there was a great improvement, and on the seventeenth she lay on her side and complained of hunger. On the nineteenth day the pyrexia was absent, and on the twenty-second she was convalescent, the bowels were acting naturally, and she took fish. She left the hospital on the thirty-third day.

Analysis of symptoms.—There was moderate delirium during the ninth, tenth, and eleventh days, when the abdominal disease was most urgent. The tongue became moist and was clean on the fourteenth day. The daily average of the pulse from the day of admission to the day of convalescence was 100. It fell to 108 on the eighth day, and again attained its maximum 120 on the twelfth, and thenceforward declined.

CASE 14.—*A case of moderate severity. Death from inanition and exhaustion on the thirty-eighth day. Cicatrization of the intestinal ulcers.*

Catherine M—, æt. 30, a spare, weakly woman, the mother of Ellen (see Case 24), was admitted on the fourth day of a febrile attack, which began with rigors, headache, and pains in the limbs. A few rose papules appeared on the sixth day, when the tongue was dry, brown, and cracked. Next day there was

[1] Sordes, severe prostration and pyrexia, dorsal decubitus, delirium, and a parched tongue.

a plentiful crop of rose rash, sordes on the teeth and tongue, and considerable pyrexia and prostration. The stools were still formed, and the bowels rather confined.

Up to this, the sixth day, she took acetate of ammonia, and the daily average of the pulse was 117.

Treatment.—She took ℥xv Succi belladonnæ, sextis horis, from the seventh to the thirty-fifth day; and from the twelfth to the twenty-sixth day gr. j, Opii (pilulæ saponis compositæ gr. v) in addition.

Progress.—The rash continued to appear until the eighteenth day. She had moderate diarrhœa (from one to three watery stools in the twenty-four hours) from the seventh to the twenty-eighth day. The daily average of the pulse from the seventh to the thirty-third day was 113. On the thirty-third day convalescence had seemingly begun, the pulse was 112, and she was impatient for meat. On the thirty-fifth day, after non-action of the bowels for five or six days, a simple enema brought away a soft and natural motion. On the thirty-seventh day she took fish and enjoyed it, but the stomach did not retain it; the sickness increased the prostration, which was a marked feature throughout her illness. A vesicular rash of bloody serum broke out over both elbows and knees, the pulse rose to 132, and she sunk the next day apparently from inanition, greatly emaciated.

She was evidently badly nourished when the illness overtook her, and hunger was a prominent symptom on the eleventh and twenty-eighth days and subsequently. On the twenty-third day the pulse obtained its maximum, and there was active delirium for forty-eight hours; but on the twenty-seventh day she was lying composedly on her side, and she slept tranquilly through the greater part of her illness. The tongue moistened on the eleventh day; and, except on the fourteenth, it was afterwards quite moist.

The *post-mortem* examination revealed smooth and almost pale cicatrices in the place of Peyer's patches in the lower part of the ileum, and above this, ulcers in an advanced state of cicatrization. The large intestine was healthy, and contained healthy fæces. The liver was friable and greasy. Both lungs were bound to the chest-walls by old membranous adhesions, and the lower lobes were in a state of splenization.

CASE 15.—*An attack of moderate severity, with limited bronchitis. Convalescence on the thirtieth day.*

Jane J—, æt. 19, was admitted on the fifteenth day of an attack of fever, with diarrhœa and rose rash, moderate pyrexia, pulse 124, abdomen painful, tongue moist.

Treatment.—She took from the sixteenth to the twenty-eighth day ♏xv Succi belladonnæ, sextis horis; and from the nineteenth to the twenty-sixth ♏x Spiritus terebinthinæ, ter in die, and also ℥iv of wine a-day.

Progress.—Fresh rash appeared till the nineteenth day. The diarrhœa ceased after the twenty-first day. There was prostration and limited bronchitis from the nineteenth to the twenty-third day. On the twenty-sixth day there was great improvement and hunger. On the twenty-eighth the pulse and temperature were normal, the bowels constipated, and she once vomited her food (custard). The next day the skin was perspiring freely. She was convalescent on the thirtieth day, but required several doses of castor oil subsequently to relieve constipation.

CASE 16.—*A moderately severe attack of enteric fever, with prostration and apathy. Convalescence dated from the thirty-eighth day.*

Johanna G—, æt. 12. Admitted on the seventeenth day of an attack of fever; abdomen tense and painful, and exhibiting a few rose papules; pulse 116; apathetic.

Treatment.—She took ♏xv Succi belladonnæ, sextis horis, from the eighteenth to the thirty-eighth day.

Progress.—The pulse fell to 100 the day after admission, and from this time to the thirty-eighth day the daily average was 78. Fresh rash appeared till the twenty-seventh day. There was delirium on the twentieth and twenty-first days, and she was drowsy and apathetic on the twenty-second. The tongue was moist throughout, and, excepting during the second week, there was no diarrhœa.

CASE 17.—*A moderately severe attack of enteric fever. Convalescence on the thirtieth day.*

Jane S—, æt. 18, was admitted on the tenth day of a severe attack of fever, which was attended with purging and vomiting from the first. There were a few rose papules on the abdomen; pain in the cæcal region and high fever; and a dry, red, and cracked tongue.

Treatment.—She took ℥xv Succi belladonnæ, sextis horis, from the eleventh to the thirtieth day; and gr. j Opii, omni die, from the thirteenth to the twentieth day.

Progress.—Fresh rash appeared till the twenty-first day. Diarrhœa was rather severe between the thirteenth and eighteenth days, when it ceased, and was followed by constipation. On the twenty-second day the motions were hard, and there was hunger. The daily average of the pulse was 77; the tongue moistened on the twelfth day, and continued moist and clean, but abnormally red throughout.

CASE 18.—*Acute tuberculosis of the lungs and intestines, simulating ordinary pneumonenteritis. Death on the eighteenth day.*

Charity G—, æt. 15, fair and fat, admitted on the eighth day of her illness, which arose from cold, and was attended by anorexia and diarrhœa. The pyrexia was moderate; pulse 116; the tongue dry, red, and cracked, but moist at the edges; abdomen natural, with eight or nine rose papules; diarrhœa; the face much flushed.

Treatment.—She took ℥xv Succi belladonnæ, sextis horis, from the eighth to the eleventh day, and ℥viiss from the eleventh to the eighteenth. Poultices were continually applied to the abdomen from the fifteenth day, and she took ℥viij of brandy on the sixteenth and seventeenth days.

Progress.—The patient got rapidly worse; the pulmonary congestion and abdominal inflammation became intense; the iliac and umbilical regions were very painful and tender; fresh rash was developed until the fifteenth day. There were delirium and sordes on the tenth day. On the sixteenth the pulse was

140, and on the eighteenth day 178, and the respirations 50; the surface became livid, the abdomen distended, and she died on the eighteenth day.

The whole of the glands of the last three feet of the ileum were enormously swollen and converted into yellowish-black sloughs, surrounded by dark purple elevated and almost bleeding edges. The lungs weighed 3½ pounds, and were severely congested and stuffed with sago-like grains of recent tubercle.

CASE 19.—*A moderately severe case. Convalescence on the thirty-third day.*

Ann B—, æt 8. Ill a fortnight before admission. On the fifteenth day of the disease enteric fever was fully developed; rose spots on the full, painful abdomen; watery ochre-coloured stools; tongue red and cracked; pulse 120; temperature 101·4.

Treatment.—From the fifteenth to the thirtieth day of the disease she took ℥xxx Succi belladonnæ, quartis horis, and thenceforward to the thirty-fourth day the same dose every six hours.

Progress.—There were never more than three watery stools in the twenty-four hours, and some days only one. The temperature reached 103·2°, and the daily average of the pulse was 110. The tongue was moist from the sixteenth day onwards, and usually clean and red; the skin, however, continued harsh and dry. There was no diarrhœa after the twenty-fifth day, and on the thirtieth day the motions were hard. Convalescence was established on the thirty-third day.

CASE 20.—*A mild case. Convalescence on the twenty-third day.*

Mary W—, æt. 7. Admitted on an undeterminable day of pyrexia and abdominal tenderness, with occasional diarrhœa. Symptoms of enteric fever were not positively declared until the eleventh day after admission; up to which time the daily average of the pulse was 112, ranging from 144 to 92. She took acetate of ammonia.

Treatment.—℥xv Succi belladonnæ, sextis horis, from the eleventh to the twenty-second day.

Progress.—On the fourteenth day the pulse had fallen from

128 on the eleventh, to 92. Moderate diarrhœa continued for several days, but the pulse gradually fell to 84, and her condition improved, so that on the twenty-third she was convalescent and took fish.

CASE 21.—*A mild case. Convalescence on the eighteenth day.*

Annie H—, æt. 6. Admitted on an undeterminable day of a pyrexial attack, which proved on the fourth day of her residence in the hospital to be due to enteric inflammation. Up to this date she took acetate of ammonia, and the daily average of the pulse was 123.

Treatment.—From the fourth to the eighteenth day she took ℥xv Succi belladonnæ, sextis horis.

Progress.—The diarrhœa was moderate, and she was convalescent on the eighteenth day; indeed, she began to eat fish on the fourteenth day.

CASE 22.—*A case of moderate severity. Delivery of a seven and a half months' child on the thirty-first day. Relapse on the fifty-second day. Convalescence on the sixty-eighth day.*

Charlotte L—, æt. 38, pregnant, between seventh and eighth months. Admitted on the twenty-first day of an attack of fully developed enteric fever. The rose rash was present. On the average there were two watery stools a day; pulse 128, of good volume and power; temperature 103°; tongue parched, covered with a thick layer of cracked exfoliating epithelium; pupils dilated.

Treatment.—She took from the twenty-first to the sixty-second day ℥xv Succi belladonnæ, sextis horis.

Progress.—The eruption continued to appear until the thirtieth day; the pulse declined, numbering day by day 108, 104, 104, 104, and 112; the tongue was damp; the diarrhœa was unchecked. On the thirty-first day labour pains came on, and she was delivered without undue hæmorrhage. Both mother and child progressed favorably. The lochial discharge was scanty, and ceased on the forty-sixth day; the diarrhœa moderate; and the pulse, after attaining a maximum of 116 on the thirty-second day, declined to 88 on the fortieth, when the tongue and skin were naturally moist. The bowels had not

acted for two days; and there was desire for solid food. No milk was secreted, and on the forty-second day the breasts were small and flaccid: she had previously had abundance of milk, and nursed eleven children. The motions on this day were solid, the pulse 100, and she appeared convalescent. She took fish on the forty-second, but the bowels again becoming loose on the fifty-second day, it was discontinued on that day. The relapse, with vomiting of bilious matter on two or three occasions, diarrhœa alternating with constipation, and the eruption of fresh spots, continued until the sixty-seventh day. After which she rapidly convalesced, and was quite well on the seventy-second day, and both the patient and her infant left the hospital well on the eightieth day.

The relapse was attended with greater pyrexia than the first part of her illness, the daily average of the pulse being 110. On the day after the belladonna was omitted it fell from 120 and 124 the two previous days to 108, and then gradually declined.

CASE 23.—*A mild case. Convalescence on the twentieth day, followed on the twenty-sixth by a mild attack of variola.*

Elizabeth S—, æt. 23. Admitted on the sixth day of an attack of enteric fever. A rose rash was present on the chest and abdomen; the pyrexia was considerable; pulse 132; temperature 103·1°; the bowels confined; the tongue moist and coated. She took acetate of ammonia until the tenth day. There was a plentiful eruption of rash, constipation, and a declension of the pulse to 108.

Treatment.—From the tenth to the eighteenth day she took ℥xv Succi belladonnæ, quartis horis.

Progress.—Excepting a considerable rise of pyrexia on the eleventh day, accompanied by diarrhœa, the symptoms rapidly abated, and she was convalescent the eighteenth day, and continued well up to the twenty-sixth day, when she had a slight pyrexial attack, followed by a sparse eruption of modified variola, which was very prevalent at this time.

The daily average of the pulse during the exhibition of the belladonna was 102, as against 114 during the use of acetate of

ammonia. On the fifteenth day the skin was sweating and of normal temperature.

CASE 24.—*A moderately severe case. Constipation during the third week. Convalescence began on the forty-second day.*

Ellen M—, æt. 6 (daughter of Catherine; see Case 14). Admitted about the fourteenth day of fever. Pulse 136; temperature 104°; epigastrium tender; tongue moist and coated.

Treatment.—℥viiss Succi belladonnæ, sextis horis, from the fourteenth to the fiftieth day. Poultices to the abdomen. ℥x Tincturæ opii per rectum on the twenty-eighth day.

Progress.—The bowels were costive till the twenty-second day. From this date to the thirty-fourth day the diarrhœa was severe, the abdomen tumid, and on one or two occasions there was bilious vomiting. On the fortieth day she had the first consistent motion. Convalescence began on the forty-fourth day. On the fiftieth the bowels were acting naturally, the tongue was clean and moist, and there was hunger. She left the hospital well on the sixty-second day.

The daily average of the pulse from the fourteenth to the forty-fourth, when it had descended to 88, was 108. From the fourteenth to the twenty-ninth day the tongue was dry and brown; for the next six days it was merely dry or dryish, and thenceforward moist; and on one of these days there was vomiting. There was no delirium throughout.

CASE 25.—*A case of ordinary severity. Convalescence on the thirty-second day.*

Ellen S—, æt. 13, was admitted on the fifth day of a febrile attack, attended with headache and severe pains in the limbs. On the sixth day she was drowsy. Temperature 102·4°; tongue moist and coated; pulse 120; and the bowels confined. The constipation continued until the ninth day, when the bowels become loose, and rose spots appeared on the abdomen. During the next two days the enteritis was fully developed. Up to this time she took acetate of ammonia the pulse ranged from 120 to 100, and the tongue was moist and coated.

Treatment.—From the ninth to the twenty-third day she took ℥xxx Succi belladonnæ, quartis horis.

Progress.—On the tenth day the pulse was 116, as on the ninth, before the belladonna was given. On the two following days it decreased to 112, and next day to 92. On the fifteenth and sixteenth days it rose to 104, and then gradually declined to 88, the number on the twenty-third, the day of convalescence. The daily average of the pulse for seven days before the use of the belladonna was 115; the average for fourteen days during its use was 100. The diarrhœa attained its maximum on the thirteenth, fourteenth, and sixteenth days, when the motions were watery and very frequent. The tongue was moist throughout the illness: it was coated with white fur up to the tenth day, and then gradually became clean. She took full diet on the thirty-second day.

Case 26.—*A severe attack, complicated with broncho-pneumonia. Relapse on the thirty-fourth day. Convalescence on the seventieth day.*

S. L—, æt. 17. Admitted on the fifth day of an attack of fever, with acute pulmonary congestion; constipation; a moist, white, furred tongue, and moderate pyrexia. The symptoms of enteritis were developed on the twelfth day. The average of the pulse for the previous six days (fifth to eleventh day) was 115.

Treatment.—From the eleventh to the sixteenth day she took ℥xxx Succi belladonnæ, and thenceforward to the thirtieth day ℥xv, every six hours. Poultices were continually applied to the chest; and from the fourteenth day onwards ℥iv of brandy were given daily.

Progress.—From the twelfth to the eighteenth day there was severe diarrhœa and diffuse broncho-pneumonia, and the condition of the patient was critical, and she lay on the back with flushed cheeks, nearly apathetic, until the nineteenth day. On the fourteenth day the pulse was 132, the tongue parched, and there was delirium. Excepting on this day, the tongue was moist and gradually became clean. She was convalescent and took fish on the thirtieth day.

Analysis of the symptoms.—Diarrhœa continued until the nineetenth day; on the twenty-first and afterwards the motions were solid. Free expectoration occurred on the nineteenth day, and thenceforward declined.

The furred tongue became parched on the fourteenth day, but the following day and afterwards it was continually moist and nearly clean.

Free sensible perspiration appeared on the nineteenth day.

The pulse averaged from the twelfth to the thirtieth day 100. It reached its maximum of 132 on the fourteenth, and again on the nineteenth day.

She was delirious on the thirteenth, fourteenth, and fifteenth days.

On the thirty-fourth day there was malaise with epigastric tenderness and nausea; and on the thirty-sixth day a distinct relapse of enteric fever, with bronchitis on the forty-first, and she went through a repetition of her former illness. She convalesced on the sixty-fifth day; but, though very hungry, could not take meat diet without reproduction of diarrhœa until the seventy-seventh day.

In the second attack she was simply treated with acetate of ammonia. The pulse averaged during the twenty-eight days (from the thirty-sixth to the sixty-fifth) of the relapse 115·5. The tongue, as in the former attack, was for the most part clean and moist throughout. The pyrexia and other symptoms were rather more severe in the relapse than in the primary fever.

Case 27.—*A severe case, complicated with extensive pulmonary congestion. Convalescence on the fifty-eighth day.*

Catherine K—, æt. 12. Had been ailing about three weeks before admission with "pain in the stomach and back and occasional looseness of the bowels." The abdomen was full, the pulse 104, temperature 103°, and she was drowsy and apathetic.

Treatment.—She took ℥viiss Succi belladonnæ from the twenty-first to the fifty-first day, and for some time linseed poultices were constantly applied first to the abdomen and then to the chest.

Progress.—The day after admission (twenty-second day) she

had a semisolid, light yellow stool; the next day the abdomen was tense and tender, and there were three loose, ochre-coloured stools. On the twenty-fifth day pneumon-enteritis was fully developed, and she was in a typhous state. The respirations were forty-eight, and there was crepitation in the bases of both lungs. A copious rose rash on the front of the trunk, and slight epistaxis. The bowels were alternately loose and confined up to the thirtieth day, after which there was no diarrhœa and a subsidence of both the abdominal and pulmonary symptoms. She, however, continued in a typhous state, sometimes passing her evacuations in bed until the fortieth day, when she became fretful. Intelligence then rapidly increased, and she was able to take fish on the fifty-first day. The daily average of the pulse during the pyrexial state (the nineteenth day following her admission) was 108·3. The maximum (120) was attained on the twenty-eighth and twenty-ninth days. The tongue continued parched and covered with sordes up to the thirty-third day.

On the fiftieth day the temperature was normal, the pulse 84, the skin natural, and the tongue clean and moist.

CASE 28.—*Fully developed enteric fever, with normal or nearly normal temperature and pulse throughout. Convalescence on the twenty-sixth day.*

Emily H—, æt. 14. Had been ailing for a week before admission, and the last two days she had rigors, headache, sickness, and pains in the limbs. The temperature was 102·6°, the pulse 112. Respiration 28. Abdomen natural; no diarrhœa. Tongue moist and furred.

Treatment.—She took ℿx Succi belladonnæ, quartis horis, from the seventh to the twenty-sixth day.

Progress.—On the eighth day four or five rose papules appeared on the abdomen, and there were two loose, light yellow stools. Fresh rash appeared until the twenty-third day; diarrhœa continued rather profuse some days until the seventeenth day, and there was subsequent constipation. The pulse and temperature declined, and, as will be seen in the following table, were almost normal throughout.

	Temp.	Pulse.
7th day	102·6°	112
8th „	102·2°	104
9th „	100·5°	100
10th „	100·6°	100
11th „	99·8°	84
12th „	98·4°	76
„ evening	100·2°	86
13th day	98·4°	88
14th „	98°	72
„ evening	100·2°	80
15th day	98·4°	80
16th „	100°	92
„ evening	100·1°	76
„ „	99·3°	
17th day	98·6°	84
„ evening	101·8°	
18th day	98·4°	84
19th „	99°	84
„ evening	100°	86
20th day	97·6°	64
„ evening	100°	
21st day	99·1°	92
„ evening	98·4°	84
22nd day	99·1°	92
„ evening	98°	84
23rd day	...	84
24th „	98·8°	100
„ evening	98·4°	96
25th day	99·8°	96
„ evening	99·6°	104
26th „	98·4°	84
27th day	98·4°	84
„ evening	99°	
28th day	99°	96
30th „	99°	100
„ evening	97·5°	96
31st day	„	„

The tongue was moist and nearly clean throughout, and the mind was clear. This and Case 27 were two of fourteen patients who were admitted into the hospital from a school at Highgate, where enteric fever was for a time endemic.

The preceding abstracts of cases have been taken in the order in which they appear in my note-books. They will be found sufficient, I think, both as to number and variety of the symptoms, to illustrate the use of belladonna in this disease. Owing to the various complications and accidents which attend the course of enteric fever, it is perhaps more difficult to estimate the value of a given drug in this disease than in any other, and a correct estimate can only be formed from a large number of cases.

Analysis of the foregoing cases with reference to the degree of development of the particular symptoms, shows the following results:—1. As to the pyrexia. It appears that *the rate of the pulse and the degree of temperature* were never, as a rule, increased, but,

on the contrary, both these symptoms uniformly declined under the use of belladonna. The daily averages of the pulse above given are, considering the severity of the cases, certainly low. My own impression is that the stimulant action of belladonna on the heart is converted in the pyrexial state into a tonic and, if not pushed too far, even a sedative influence on the heart and blood vessels generally; in other words, that it is a tonic and sedative to the sympathetic nervous system generally. This I take to be the fundamental explanation of its effects in the febrile state. By this action the capillary circulation is accelerated, the contraction of the vessels promoted, and thus the arterial tension which attends congestion of the parenchymatous organs is relieved, and a load at once removed from the heart. Diminuition of temperature is the direct consequences of these changes.

As the result of the prolonged use of belladonna after the cessation of the pyrexial stage, I have noted an irritable debility of the heart as if it had been exhausted by over-stimulation, and the nervous system has also shown a participation in this effect. Thus, with reference to the heart, a young woman, æt. 18, for example, continued to take a moderate dose (mx) of belladonna juice every four hours for nine days after convalescence, and as she reclined on her bed in a state of rest, the pulse numbered 60 and the respiration 16. With the finger still on the pulse, and after three or four deep inspirations, it rose immediately to 88. In these cases there is generally a little hurry and excitement, and a liability to flushing when spoken to. These, the usual consequences of prolonged fever, are, I believe, exaggerated by the abuse of belladonna. When taken in conjunction with the fact stated in the outset, it appears that the beneficial use of belladonna lies, with narrow limits as to dosage, and that vigilance must be exercised lest these limits be exceeded.

As to *delirium*. Except in a very small proportion of cases, I have not observed that this symptom in enteric fever is increased by belladonna, and I have never withheld the drug on account of delirium. In the three or four cases referred to, I have not always been sure that the delirium and belladonna have stood to each other in the relation of effect and cause. Speaking generally, the effect of the belladonna was to diminish

the insomnia so frequently present, and it may therefore be said to have a slight hypnotic and calming effect on the cerebro-spinal system.

As to the condition of the *tongue and skin*. One of the most noticeable effects of belladonna in the pyrexial condition is moistening of the tongue. In many of the cases above recorded the patient had been admitted with a dry, parched tongue, and it has become soft and moist after a few doses of belladonna, and has remained so during the further progress of the disease, notwithstanding, in many cases, an increase in the severity of the general symptoms. No particular effect on the skin was noted, but those critical sweats, attended as they commonly are in this disease by a copious eruption of sudamina, occurred as frequently and abundantly as when no belladonna was given (see, *e. g.* Cases 7, 10, 23 and 26).

As to the *alvine discharges*. As far as I could determine, the diarrhœa was not directly influenced either way; but in those cases in which the belladonna was given from an early stage of the disease, it appeared to me to be of shorter duration. The tendency to hæmorrhage in like manner appeared to be uninfluenced—directly at least. It happened in 12, or about 5½ per cent. of the cases treated. The point to which I particularly directed my attention was the reappearance of bile in the stools, and I have a decided impression that the liver was restored to a healthy action at an earlier date in the belladonna cases than in those treated by ordinary remedies (such as chalk, catechu, dilute sulphuric acid, and opium). This was indicated by the yellowish-brown colour of the fæces, and sometimes by bilious vomiting about the third week of the disease; and in many cases by an early cessation of the diarrhœa and the formation of solid, normal-coloured fæces.

Passing from these particular indications, I will now give the general results as indicated by the proportionate mortality.

The total number of patients treated with belladonna during the whole or only a portion of their illness was 228, of whom one half were females.

The average age was 18 for both sexes, and the average duration of residence in the hospital about 37 days.

Of the total numbers 28 died, *i.e.* 1 in every 8·14, or 12·28 per cent.—a low rate of mortality, but susceptible of being placed in

a more favorable light still, as the following facts will show. The belladonna treatment was soon applied indiscriminately, and only withheld when the increase of delirium, urgent pulmonary symptoms, hæmorrhage, or perforation rendered the use of other remedies imperative. Belladonna was therefore given to a number of patients admitted in the third, fourth, or even fifth week of their disease, and of some of whom it may truly be said that they were brought into the hospital to die. This will appear from the following brief summary of some of the fatal cases included in the mortality estimate given above.

1. Martha H—, æt. 21, was ill a month before admission, and died ten days afterwards. The lower end of the ileum was loaded with thick-margined congested ulcers. The right lung was bound down by old adhesions, and the upper lobe as well as the lower lobe of the left lung spleenified.

2. Catherine M— (see case, p. 215) had almost completely recovered from the intestinal lesion, the fæces being normal, and all but one or two ulcers healed, when she sank of sheer inanition.

3. Charity G— (see case, p. 218). In this case general tuberculosis was undoubtedly fully developed before she was admitted into the hospital, of which she was an inmate only eleven days.

4. Rachel S—, æt. 12, was admitted at a late period of the disease in a typhous state, with sordes on the teeth and a pulse of 140. She took belladonna only two days, and died five days afterwards.

5. Mary J—, æt. 23, was also admitted at a late period of the disease in a typhous condition, with sordes and active delirium. She took belladonna two days only, and died five days after admission.

6. Elizabeth D—, æt. 16, was also admitted in a typhous condition, and with sloughing of the labia pudendi. She took belladonna only two days, and died on the tenth day of her sojourn in the hospital.

7. John C—, æt. 14, was admitted in the fourth week of his illness, delirious, and with a pulse of 130. He died seven days

afterwards of perforation, which appeared to have occurred before admission, for there was no indication of any fresh abdominal lesion afterwards.

7. James B—, æt. 19, was admitted at the end of the fourth week of his illness. He took belladonna only four days, and died on the fifth day after admission. The lower lobes of both lungs were in the stage of red hepatisation; angry, bleeding ulcers still occupied the sites of the lower Peyer's patches.

9. Leonard D—, æt. 10, was admitted in a prostrate condition in a late stage of the disease, and died after forty-eight hours, when it was found that the pericardium was wholly adherent (old adhesions), the valves of the left heart had been the seat of previous rheumatic endocarditis, and the ulcers of the ileum were nearly healed.

How far these cases should be excluded in calculating the death-rate and in determining the remedial influence of belladonna in enteric fever, or rather that concurrence of pulmonary and enteric inflammation, which I have elsewhere termed pneumonenteritis, I will leave the reader to determine. I have felt it proper to bring forward every case in which belladonna was given, but it will at once be conceded that Cases 4, 5, 6, and 9 just specified should be excluded. This would reduce the death-rate to 1 in 9·3, or 10·71 per cent.—a most satisfactory result.

Six of the whole number died of perforation of the ileum. Pneumonia was the immediate cause of death in a considerable proportion of the remainder.

The belladonna treatment was continuously pursued throughout two years, viz. from November, 1869, to November, 1871; and during this period I find that 131 other cases of enteric fever in my practicewere treated in the usual way.[1] From this it might be inferred that a selection was made of the cases as to the particular treatment to be adopted, but this was not so, but the variation was determined by several causes; thus, in a number of cases enteric symptoms were undeveloped for some time, during which the nature of the case was somewhat doubtful, and in these cases the treatment first adopted was continued; or a sudden outbreak of diarrhœa or hæmorrhage called for astrin-

[1] All these cases came under my care in the London Fever Hospital.

gent remedies. At one time the supply of belladonna was exhausted and not immediately renewed. At another time a temporary change in the resident medical officers in charge of my patients led to the adoption of the ordinary treatment, which I was glad to continue, in order that I might have a number of concurrent cases with which I could compare those treated by belladonna.

These cases, 131 in all, that is rather more than half the number of the belladonna cases, afford the following statistics:— 20 or 1 in 6·5 died, thus giving a death-rate of 15·26. But 3 of these died within twenty-four hours of their admission into the hospital, thus reducing the mortality to 13·28. This is a low rate as compared with that of the whole number of patients suffering from enteric fever admitted into the London Fever Hospital during a period of twelve years (from 1848 to 1859). The mortality for this period was 17·26, and after deducting the deaths which took place within forty-eight hours after admission, 15·82.[1]

The question suggested by my own figures is, whether the diminished rate of mortality in the cases under ordinary treatment should be attributed to the use of belladonna in the greater proportion of the whole number of cases?

This is a question which must be decided by a further experience of the drug. I think I have adduced sufficient evidence to show that the use of belladonna in enteric fever has been so far attended with good results; and that the theory of its action, which I have propounded at the outset, has been borne out in practice.

[1] Murchison, 'Contagious Fevers of Great Britain,' 2nd edition.

29 SEP 1920
PROOF

ON CAMPHOR.

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THE PHYSIOLOGICAL ACTION OF CAMPHOR.

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Most of us prescribe camphor daily; and while all of us regard it as a cleanly and palatable vehicle for more active drugs, few of us, I presume, have any very definite views of its medicinal properties. The usual dose is about half a grain (= ℥j. aquæ camphoræ[1]) every four hours, making a total of about 3 grains in the twenty-four hours; and we rarely or never prescribe more than 5 grains for a single dose. Now, since 5 grains are insufficient to produce any appreciable symptoms, it follows that as a rule the majority of medical men have never observed the physiological effects of camphor. The object of this paper, therefore, is to set the medicinal effects of camphor in a clear light. I have been induced to test the therapeutical value of the drug in a few cases, and in these I have had an opportunity of learning something of its physiological action when given in doses which have been reported as poisonous. As I wish to give as complete a view as I am able of the action of camphor, it will be necessary and I think interesting to give a brief account of a few recorded cases of poisoning by camphor before I lay before my readers the results of my own imperfect observations.

The following cases are for the most part to be found scattered through our works on Toxicology and Medical Jurisprudence. In selecting them I have been careful to discriminate between the real effects of camphor and those due to other causes. How necessary it is to do this will be seen from the following instances of so-called poisoning.

[1] 1,000 grains of water take up about 1 grain.

CASE I.—A young woman, aged 27, suffering from nervous symptoms, "neither epileptic nor hysterical," received as an antispasmodic 4 grammes, = 60 grains, of camphor. Two minutes after the enema the patient complained of a sense of fainting, and pain in the abdomen; she was then seized with a violent convulsive attack, attended with loss of consciousness, foaming at the mouth, &c., and extreme distress in respiration. The paroxysm lasted twelve or fifteen minutes, when the patient recovered consciousness. A purgative enema was given to remove the camphor, and other remedies applied to raise "a feeble pulse," relieve "the distress in breathing," and to calm "the agitation and anxiety of the patient," and at the end of four hours after receiving the enema she was out of danger.[1]

It is to be observed that the symptoms came on two minutes after the introduction of the camphor, and it is quite plain (as will appear from all the other cases) that they were not due to the absorption of camphor, which could not take place in the time. The fit probably differed little or nothing from those to which the patient was liable. The rest of the symptoms must be regarded as the after effects of the epileptiform attack.

CASE II.—A villager of Neudorf, in Strasburg, gave to each of her two sons, one of three and the other of five years old, and to her infant, eighteen months old, a dose of about a tablespoonful (180 grains) of powdered camphor as a vermifuge. After half an hour, nausea, vertigo, and muscular twitchings came on. After an hour and a half, vomiting and convulsions followed, and then loss of consciousness and a frequent "desire" to pass urine. The three little patients were simultaneously the subjects of violent convulsions, in which the facial muscles were implicated, and they were tormented with incessant vomiting, purging, and voiding of urine. The attack lasted three hours, and was followed by a comatose sleep of several hours' duration. The means employed were *emetics, purgatives,* and *narcotics.* The urine had the odour of camphor. The infant died within seven hours, comatose; the other two soon recovered.[2]

[1] M. Aran, Communication to Med. Soc. of Parisian Hospitals, Lond. Med. Gaz. vol. xlviii. p. 552.

[2] M. Schaaf, Journal de Chimie Médicale, 1850. Lond. Med. Gaz. vol. xlvii. p. 219.

Dr. Taylor[1] also refers to vol. xlvii. of the *Medical Gazette* for the account of this case, and yet he states that the dose given to each child was about 30 grains (half a teaspoonful). I have been unable to refer to the *Journal de Chimie Médicale,* but even granting it was the smaller dose, the presence of worms in, and the administration of a teaspoonful of powdered camphor to, a child 18 months of age, are two statements difficult to accept. Incessant vomiting, purging, and vesical irritation are not (as will appear from all the other cases) the effects of camphor. Vomiting was no doubt caused by the emetics, purging by the purgatives, and, it may be, coma and death by the narcotics employed in the treatment of the patients.

Case III.—An adult male took 30 grains of camphor as an enema. After a few minutes he perceived a taste of camphor in the throat. The enema having been retained a quarter of an hour, he became uneasy and generally unwell. On rising from his bed he was surprised to find that he felt lighter than usual, and he seemed to skim along the ground as he walked, and he staggered in walking. He then appears to have become alarmed by these symptoms, and felt weak and faint. He took a glass of wine, and the symptoms, which had continued for about half an hour, gradually passed off. During the rest of the day he exhaled by the mouth a strong odour of camphor.[2]

In this case the symptoms appear to be chiefly due to alarm caused by the retention of the enema, and the slight giddiness induced by the camphor.

Case IV.—A child, suffering from cerebral disease, had been for some hours lying perfectly senseless and quiet, with a slight flush on the cheeks, squinting, pupils dilated, and the pulse 64, intermitting every fourth stroke. In this state Mr. George determined to try the effects of camphor on the heart, and in order thereto enveloped the chest in flannel soaked in a solution composed of one part of camphor and two of rectified spirit. In less than five minutes the child became pale, moaned, and appeared restless and distressed, the pulse beating so rapidly that it was

[1] Pereira's Elements Mat. Med. vol. ii. Part II. p. 456, and Med. Jurisprudence, 5th edition, p. 177.

[2] Orfila, Traité de Toxicologie, 4th edition, vol. ii. p. 496. Quoted by Christison, p. 909.

almost impossible to count it. These effects increasing, the application was removed, and the child returned in a few hours to the condition in which it was before the camphor was applied, and died in about twenty-four hours.[1]

This case is recorded to show the stimulant effect of camphor on the heart. It hardly need be said that the cardiac excitement was due to the pain and bodily disturbance caused by the application.

CASE V.—An adult patient, in the enjoyment of perfect health otherwise, inhaled the vapour of camphor for some hours in order to cure a catarrh. After a time he felt himself overwhelmed with a general and unaccountable lassitude. The head became heavy, stupid, and painful, the vision disordered, and there was shivering at intervals. Soon he was unable to stand; faintings and nausea supervened; and the physician, M. Journez, found him in a state of extreme prostration, pale, and trembling, with a tendency to slight faintings, a slow soft pulse, and the breathing quick and irregular. He soon recovered, and the urine exhaled a very marked odour of camphor. Previous to inhalation the camphor was moistened with alcohol.[2]

In this case the shivering, nausea, and faintness were probably due to alarm.

In the following cases the symptoms recorded are purely those induced by camphor.

CASE VI.—Mr. Alexander took 20 grains of camphor, and finding that it did not cause any particular symptom, swallowed, on another occasion, 40 grains mixed with syrup of roses. In the course of twenty minutes he became languid and listless, and in an hour giddy, confused, and forgetful. Objects quivered before his eyes, and a tumult of crude ideas floated through his mind. At length he lost all consciousness, during which he was attacked with strong convulsive fits and maniacal frenzy. These alarming symptoms were dispelled by an emetic, which brought away almost the whole of the camphor which had been swallowed three hours before.[3]

[1] London Medical Gazette, vol. ix. p. 662.

[2] Archives Belges de Méd. Militaire, and Journal de Chimie Médicale, 1860, Fourth Series, vol. vi. p. 466.

[3] Experimental Essays, p. 128, quoted by Christison "On Poisons," 4th edition, p. 909.

CASE VII.—An adult male took 40 grains of camphor dissolved in olive oil. Vertigo, cold extremities, great anxiety, cold sweating of the head, slight delirium attended with somnolency, and a small languishing pulse, were the symptoms at first experienced, but they were soon followed by great heat and a quicker pulse.[1]

CASE VIII.—A drunkard swallowed ℥iv of camphorated spirit, = 160 grains, of camphor. Soon afterwards he became feverish, with burning heat of the skin, burning pain in the stomach, giddiness, flushed face, dimness of sight, and some delirium. The poison was retained, but the man soon recovered.[2]

CASE IX.—A weak, nervous woman, aged 36, took 180 grains of camphor dissolved in a glass of brandy, with the view of producing abortion, being about four months pregnant. During the first hours which followed its ingestion she experienced symptoms of intoxication, headache, flushing of the face, and a sensation of heat in the stomach; but eight hours afterwards she began to suffer pain, at first moderate, but afterwards very intense, in the epigastrium, radiating all over the belly and into the limbs. This was accompanied by uterine tenesmus. She continued very ill with symptoms of peritonitis, and died on the twelfth day, having aborted just before her death.[3]

The camphor appears to have set up uterine action in this case. The symptoms which followed are not to be attributed to the camphor.

CASE X.—A female adult took fasting, at 8 A.M., in mistake for castor-oil, two tablespoonfuls of camphorated oil (camphoræ ℥ss, olei olivæ ℥j). At 11 A.M. she was delirious, but when spoken to gave rational answers: she said "she had no pain, but her head turned round." Her face was pale and anxious, the pupils dilated, the hands and feet cold; the pulse 120, and feeble. At 12.30 the pulse was 108 and feeble, and she felt weak. In the evening she was quite recovered, and the pupils and pulse were natural. "During no part of the time was the respiration disturbed."[4]

[1] Orfila, op. cit. p. 496.

[2] Wendt, Rust's Mag. für die gesammte Heilkunde, xxv. 88. Christison, op. cit. p. 910.

[3] Gazette Médicale d'Orient. Bull. de Thérapeutique, and Journal de Chimie Médicale, 1860, Fourth Series, vol. vi. p. 21.

[4] Alex. Stookes, Med. Times, 1848, vol. xviii. p. 88.

Archives Gén de Méd Tome xxii. p 129. 1830 for a full

I will now give in detail an account of two cases in which camphor was freely employed. It is to be observed that the physiological effects were uniform, and that in doses not exceeding 35 grains there were simply giddiness, languor, and a diffused feeling of warmth through the body—the digestive, circulatory, with slight exceptions, and respiratory apparatus remaining unaffected.

The following solution of camphor was used on every occasion :—

℞ Camphoræ ʒiv.
Aquæ ℥ij.
Spiritûs vini rectificati ad ℥vj. f. ʒj = gr. v camphor.

The dose was taken in one or two tumblerfuls of warm water, which dissolved the greater part of the camphor, except in the case of the larger doses.

Case XI.—*Dysmenorrhœa ; chronic ovarian pain from congestion of the pelvic viscera ; camphor in doses varying from* 2 *to* 30 *grains.*—Mary L., aged 37, single, moderately dark, and spare and weakly. The catamenia appeared at the age of 14, and have continued at regular intervals up to the present time; the discharge was always rather scanty, and continued for three or four days; during the last few years the discharge has been interrupted on the third day, reappearing on the fifth, and then continuing for one or two days. For the last ten years she has had "a lump of dragging, aching pain" on the left side, extending from the navel to the groin, and settling deep in the left side of the pelvis. For the few days following the catamenial periods she is relieved, but the pain soon returns, and gradually increases in severity until the menstrual discharge again sets in. During the flow there is much aching pain in the back. The bowels are habitually confined, and the pelvic congestion is occasionally relieved by bleeding from internal hæmorrhoids, and commonly by leucorrhœa. By the use of cold-water enemata, laxatives, henbane in large doses, and chalybeate tonics, her general health was improved, and the local disorders relieved; but at the end of ten months the pelvic (ovarian?) pain continuing, I suspended all other treatment, excepting the means employed for promoting regular action of the bowels, and for the next four months administered camphor alone. At this time the uterus

was healthy, and the cervix readily allowed the passage of a sound.

Two grains of camphor were taken in solution, as above, every day for the first week, on an empty stomach. The report was that the medicine did not affect her in any way, and the following observation corroborated this statement:—At 11 A.M., the pulse being 72, regular, soft, and rather voluminous, the tongue moist, with a slight white fur, and the pupils in diffuse daylight $\frac{1}{8}''$, she took her first dose, and for the next two hours sat down and plied her needle. *After half an hour* the pulse was 62, but otherwise unchanged. *After one hour and a half* the pulse was 60, and unchanged. *After two hours* the pulse was still 60, regular, and of unchanged volume and power. There was no change in either pupils or tongue throughout.

Four grains of camphor were taken every morning for the next fortnight, an hour before breakfast. She stated that the medicine produced a sense of warmth through the whole body, and that it neither increased nor diminished her appetite.

Five grains of camphor were given to her two and a half hours after breakfast, the pulse being 64, the tongue clean, and its secretion faintly acid. *After an hour and a half* the pulse was 60, unchanged, the tongue and pupils unchanged, and no other effect experienced except the diffused sensation of warmth —differing from that induced by exercise, and especially referred to the chest and breasts.

During the fourth and fifth weeks, five grains of camphor were taken in the morning before breakfast, and again at bedtime. She continued her usual domestic occupations after the morning dose, and reported that she experienced decided giddiness after each dose, coming on after about twenty minutes, and lasting ten minutes. On two occasions the giddiness was considerable.

Ten grains of camphor were taken two and a half hours after breakfast, the pulse being 60. *Half an hour afterwards* she felt very giddy and powerless: this passed off in the course of ten minutes. *An hour and a half after the dose* she experienced no effects, and employed her time in reading. Pulse 58, unchanged. She continued to sit quiet, and *at the end of two*

hours and a quarter the pulse was 62, regular, and of the initial volume and power. The tongue and pupils were unchanged throughout. There was a general feeling of languor.

On another occasion the observations were continued until four hours after the dose. At the end of this time the pulse, pupils, and tongue were unchanged, and no effects of any kind were felt.

During the sixth week she took ten grains of camphor every morning before breakfast, and reported that each dose produced so much giddiness that she was scarcely able to walk across the room. The effect came on after ten minutes, continued at its maximum for the next quarter of an hour, and then declined, but did not pass away entirely until after breakfast, *i.e.* one hour and three-quarters after the dose.

During the next three weeks she took *fifteen grains of camphor* every third morning before breakfast: each dose produced giddiness in from five to fifteen minutes, lasting at its maximum a quarter of an hour, and continuing for an hour and a half. There was no disorder of vision, and she could continue reading when the giddiness was at its maximum. Giddiness was the only appreciable effect: there was no feeling of stimulation nor faintness, and the appetite was unaffected. She took fifteen grains under my own observation two hours and a half after breakfast, the pulse being 70, and the pupils (a sunless day) $\frac{1}{7}''$. *Half an hour afterwards* she complained of the usual giddiness, but said it was beginning to pass off. She has continued her sewing uninterruptedly. Pulse 70, of slightly increased volume and good power, and quite regular. *After an hour and a half,* pulse 63, of initial volume and power; giddiness nearly passed off, but the legs felt rather tremulous in walking. She now felt sleepy. The giddiness induced by the medicine did not dim the sight, but things did not appear quite steady before her eyes; there was a little confusion when she looked up. The pupils and tongue were unchanged throughout.

During the next fortnight no medicine was taken. From the thirteenth to the fourteenth week, camphor, in doses of ten grains, was taken twice a day. It still continued to induce giddiness, more so in the morning before breakfast, and frequently "made her very warm."

Twenty grains of camphor were given to her two hours and a quarter after breakfast, the pulse being 72, the pupils $\frac{1}{8}$, and the tongue natural. *After twenty minutes* she was very giddy, but could stand, and stoop to pick up a pin. Pulse 68 and unchanged. She continued her sewing, but shortly afterwards she was obliged to lay her needle aside, not so much on account of disorder of vision as of tremulousness of the hands; and there was slight somnolency. *After two hours and a quarter* she was still a little shaky and unsteady in her actions, and felt languid and sleepy: the pulse was 66, regular, and of its initial force and volume: the tongue and pupils were unchanged throughout. She now walked home. During the next week she took ten grains twice a day for three successive days, and on the fourth day—

Thirty grains of camphor, ten grains an hour before breakfast, and twenty grains two hours and a quarter after breakfast, the first dose being taken at 7 A.M., and the second at 10.15 A.M., when the pulse was 70, the tongue clean and moist, and the pupils at bright light $\frac{1}{10}''$. The giddiness and muscular weakness were rather less marked than after the single dose of twenty grains. She was able to continue her sewing throughout, and at the end of two hours, when she went home, the pulse was 60 and unchanged, and the tongue and pupils were unaffected.

During the following week she took ten grains thrice a day. At the end of this time she was looking well, and the lips were rosy; she however seemed languid and lethargic, and reported that the medicine made her languid and sleepy. Throughout the week she was excessively weak and languid, her legs being weak and shaky, and she was hardly able to keep her eyes open during the day: twice she had felt very faint, and she had constantly experienced a heaviness and dulness of the head, which "seemed so bewildered." There was no dimness of sight, but the vision was "flickering and weak;" in fact she was decidedly camphorised (see experiment on the mouse); the pulse was 72, regular, and of its usual volume and force; the respirations 23 one minute, and the next 19, with one long-drawn inspiration. Throughout, the digestive, circulatory, and secretive organs were apparently unaffected; the urine was not increased in quantity, or in any way altered.

and I uniformly failed to discover the odour of camphor in this or in the pulmonary or cutaneous exhalations.

During the four months she continued the camphor treatment there was decided amelioration of the dysmenorrhœa, the flow being interrupted only on one occasion, and the pelvic pain and flatulent colic were greatly relieved. As soon, however, as the camphor was discontinued all the symptoms returned.

In this case the camphor acted beneficially as an anti-spasmodic.

CASE XII.—*Frequent seminal emissions; camphor in doses from four to thirty-five grains.*—Henry A., aged 17, a strong, active young man, troubled with seminal emissions twice a week, and the usual nervous symptoms. He was greatly relieved by hemlock, ʒvj of good succus producing moderate cicutism. After an interval of some months he again applied to me, and this time I prescribed camphor. He took two doses of four grains each; after an interval of a week, seven doses of five grains each, on consecutive days; and for the next six days, five grains night and morning. The following week he took ten grains every morning before breakfast, and I then increased the dose to fifteen grains, which was taken every other morning for a week longer. During the next two months he took a dose of camphor, progressively increased from eighteen to thirty grains, at intervals of two or three days; and for four consecutive days during the latter part of the time he took thirty grains night and morning. The effect on the irritation of the sexual organs was marked, emission occurring only once a fortnight during the time the camphor was taken. No dose less than fifteen grains produced any appreciable effect. When this quantity was taken before breakfast, it caused giddiness after fifteen minutes, disappearing in the same interval of time. Giddiness lasting a quarter of an hour, and a warmth of stomach "as if he had taken spirits," followed doses of twenty grains. The following observations show the effect of twenty-five, thirty, and thirty-five grains respectively:—

Twenty-five grains of camphor were taken when the pulse after walking was 79, the pupils $\frac{1}{5}''$, and the tongue clean. *After twenty minutes* there was giddiness, but the patient did not show it, and a warmth about the chest; the pulse 76.

The giddiness lasted half an hour. *After two hours* the pulse was 73, regular, and of its usual volume and power; the pupils and tongue were unchanged throughout, and although he had been sitting still in a darkish room during the whole of the time, there was no somnolency.

Thirty grains of camphor were taken when the pulse, after a walk, was 88, full, and regular. The usual giddiness came on after a quarter of an hour, and continued for half an hour; to me it was not appreciable. *After thirty-five minutes* the pulse was 76, and had returned to its usual volume and force for a state of quietude; a diffused feeling of warmth throughout the body, but especially behind the sternum. *After an hour and three-quarters* the pulse had risen to 86, but was otherwise unchanged; the other symptoms had passed off, and there was no somnolency.

Thirty-five grains of camphor were taken after a walk, when the pulse was 86, and the pupils $\frac{1}{7}''$. Giddiness "over the back and top of the eyes" came on in a quarter of an hour, and continued at its maximum for twenty minutes. There was no default of vision. *After thirty-five minutes* the pulse was 76, full, and bounding; the cheeks hot and flushed, and there was a little somnolency: no change of pupils or tongue, and a sensation of warmth over the upper part of the chest. *After two hours* the pulse was 76, regular, and of its usual force and volume; the somnolency and flushing were gone, but he still felt heavy about the eyes. He now walked home, and experienced slight giddiness on reaching home, lasting half an hour.

No greater effects were produced when thirty grains were taken twice a day.

The urine was examined after the operation of the medicine on each of these occasions; it was always normal in quantity and composition, and it possessed its natural odour, being entirely free from that of camphor—(these observations equally refer to Case XI.)—nor was the odour of camphor in the least degree appreciable in the cutaneous or pulmonary exhalations of either patient. The respiration was not affected to any appreciable extent in either case.

I will now complete my observations on the physiological

action of camphor by a brief account of its effects on the moth and on the mouse.

EFFECTS OF CAMPHOR ON THE MOTH.

The small grey-spotted moth, the black hairy larva of which devastates the hawthorn in London during the spring, was used in the following experiments :—

A pint beaker, containing eight moths, was inverted over a lump of camphor the size of a split pea, the temperature of the room being 70° Fahr. *After fifteen minutes* all were rolling and fluttering upon the table, being now unable to retain foothold upon the glass. *After thirty minutes* all were perfectly still, and some lying on the side, but on shaking the stand they moved, struggled to keep on their feet, but most rolled over on their backs. They continued in a torpid state, faintly struggling and rolling about only when disturbed. *After eight hours* all were alive, and one-half lying on the back. *After twelve hours* five were dead, and the three remaining ones were on their backs, and incapable of changing their positions. The beaker was now removed, and they were freely exposed to the air. *After sixteen hours* they were in no degree revived, and next day two were dead, and the remaining one was crawling about pretty actively.

The experiment was repeated when the temperature of the air was 8° higher; namely, 78° Fahr. They soon began to flutter about, and, losing hold upon the glass, fell upon the table and became torpid. In the course of a few hours all were dead.

EFFECTS OF CAMPHOR ON THE MOUSE.

Five grains of powdered camphor were mixed with twice their bulk of fine sand, and placed in a muslin bag. The bag and a wild active male mouse were simultaneously placed under a glass shade of the capacity of two cubic feet, the shade being raised a quarter of an inch from the support to allow of the circulation of air, the temperature of which was 70° Fahr. The camphor vapour caused at first a little blinking of the eyes, but in the course of an hour the animal became dull and sleepy, and lay perfectly still, with the eyes half closed, the chin resting on the table, and the respirations a regular pant of 200 in the

minute. He continued in a tranquil and apparently comfortable dozy *or* sleeping condition for the *next twenty hours*, being aroused at intervals of half an hour or an hour by yawning or irritation of the skin, which, after some hours, became decidedly pink. When dozing or sleeping, his condition became so lethargic that he allowed himself to be pushed about or taken up; but when aroused by this interference, or by his own sensations, he was able to run nimbly and rear himself on his hind legs, and in this state the intelligence and senses were apparently intact. Left to his own sensations, he rarely moved, and when he did so the motions were most ludicrous; the hind-quarters were left behind as the parts in front were slowly advanced, until the body was elongated to twice its usual length, and then, as the haunches were drawn forwards, the animal took the opportunity of stretching one of the hind legs behind him, and sometimes accompanied the act by a corresponding stretch of the neck and elevation of the head, and finished the lazy performance with a prolonged yawn. Thus aroused, he would sit on his haunches and scratch and rub himself from head to tail. Occasionally he took up a bit of cheese and nibbled it lazily. There was no desire for water. Fæces and urine were passed as usual, and in normal quantity. He continued dull, and refused water twenty-four hours after the camphor was removed, but afterwards became as active and lively as ever. Independently of the slight cutaneous irritation, the effect throughout appeared to be that of a grateful soporific.

It appears from the foregoing that camphor exerts its action chiefly upon the cerebral lobes, causing at first depression of mental power, giddiness, and somnolency. The corpora striata appear to share the general sedation of the intellectual centres. Delirium comes on later, and in some cases there is considerable vivacity. If the use of the drug be continued for some time, it produces great depression of muscular power and intellectual lethargy. In the fullest medicinal doses it does not affect any of the organic functions, excepting such depression of the sexual as may fairly be considered a secondary effect of its depressing influence on the motor and intellectual centres. In all medicinal doses from the lowest to the highest it certainly does not exercise a depressant effect on the circulation. On the contrary, decided

stimulation is occasionally to be observed after large doses, and this is attended with a diffused feeling of warmth throughout the body, and a slight rise of the temperature of the surface. Given in solution, as above, I have every reason to believe that the camphor was rapidly and completely absorbed; and in the doses above mentioned, it seems to be as rapidly and completely decomposed, for I always failed to detect a trace of camphor odour in either the urine or the exhalations from the skin and lungs.

CASES

OF

DISORDERED MUSCULAR MOVEMENT

ILLUSTRATING

THE USES OF HEMLOCK.

BY

JOHN HARLEY, M.D. Lond., F.R.C.P.,

ASSISTANT-PHYSICIAN AND LECTURER ON PHYSIOLOGY AT ST. THOMAS'S HOSPITAL.

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(Received Dec. 8th, 1873, and Jan. 13th, 1874—Read Dec. 9th, 1873, and Jan. 27th, 1874.)

The four subjects of chronic muscular spasm whose medical histories are briefly given below having experienced no relief from prolonged and varied treatment, have been selected as fitting cases in which to employ hemlock and oppose its full power against the spasm, with the view of obtaining, and at the same time thoroughly testing, its remedial influence. The result, it will be seen, is encouraging.

I have availed myself of the opportunity of calling attention to the advantages which the surgeon may derive from the judicious use of a plant which relaxes muscular fibre without diminishing the common sensibility or disturbing the intellectual functions.[1]

[1] The action of hemlock on three of the patients was demonstrated at the meeting.

Coneism,[1] or the proper action of hemlock, and the degree to which it may be induced, are also incidentally considered in this communication.

CASE 1.—*Chronic intermittent spasm of the right pectoral muscles and the left sterno-mastoid, and mass of muscles on the side of the neck* (splenius, complexus, &c.)—*Spasmodic torticollis.*

The patient, W. H—, æt. 44, of dark complexion, is a strong, and otherwise healthy, muscular man, calm, intelligent, temperate, and free from constitutional disease. He is the father of eight healthy children, the eldest being twenty-one years of age. Excepting a mild attack of rheumatic fever which he experienced six years ago, the patient has been free from illness. As a millwright he was, when the present affection came on, chiefly employed in making enlarged models in wood from drawings. For the two years preceding the appearance of the spasm he was greatly overworked, and twice in the year undertook night and day work for a period of six weeks. He assigns this as the cause of the affection, for he was happy and in comfortable circumstances when it attacked him. Spasm first appeared in the arm five years ago, involved the muscles of the neck two years ago, and began to extend, as well as rotate the head, four months afterwards.

The seat and character of the spasm had never altered, and it had gradually increased in severity, notwithstanding prolonged and judicious treatment in some of our large hospitals, until natural sleep became almost impossible and life a burden. He was admitted into St. Thomas's Hospital on the 27th October, 1873. At this time the face was drawn permanently upwards and to the right; the head was still further extended and rotated in the same direction by a con-

[1] Κώνειον, hemlock.

stant succession of jerks; and the right arm was drawn across the chest and plucked still further to the left side with every movement of the head.

The neck was full and hard. It was worn bare, for he could not tolerate the restraint of a collar or neck-tie. The patient estimates the spasmodic force of the cervical muscles at fifty pounds. A forced side-glance directed downwards from a half horizontal face gave the patient a remarkably supercilious and highly characteristic expression. He had not slept without the aid of morphia for three months, but the general health was not impaired.

Treatment.—I gave him ʒj of the succus conii in the prescribing-room, and increased the dose ʒss each day until the tenth day, when he was taking ʒiij twice a day, at 11 a.m. and at 9 p.m. This was continued until the nineteenth day, and from this date to the fifty-third day, with an intermission of two days preceding his appearance at the Society, he took a single dose of ʒiij every morning.

From the fifty-third to the fifty-seventh day he took ʒiv twice a day, with an interval of twelve hours between each dose. From the fifty-seventh to the seventieth day, with an intermission of one day, he took ʒiiiss of the succus every morning. For the last week he has not taken any medicine.

Effects of the hemlock.—To speak generally, the patient and everybody about him were conscious of a decided improvement, and when his attention was diverted from himself, by reading or other mental occupation, the head was quiet. As far as I could judge, the spasm was greatly weakened, and after the forty-eighth day it became subservient to the will. He usually offered the right hand readily, and for several weeks the spasm had left the sterno-mastoid, and the face was raised upwards and to the *left* when uncontrolled by the will; but the jerk was rarely seen, the movement of the head consisting of a slow rotation or twist.

The improvement was still more marked through the night. During his stay in the hospital he never had a single dose of hypnotic, and was nightly refreshed by sound sleep.

During the action of the medicine the movements were

not diminished, but towards its decline and for some hours afterwards there was decided and often great relief. When taking only a single dose daily, at 11 a.m., he found that the most restless period was from 7 a.m. until the time of taking the dose.

Effects of the hemlock.—A fluid ounce of the succus caused some giddiness and weakness of the knees, lasting for three quarters of an hour; short of two fluid ounces there was no marked effect on the spasm. Three and a half fluid ounces caused great muscular relaxation, and at the end of two or two hours and a half, when the action had attained its maximum force, there was inability to rise from the sitting posture or to walk without assistance, and as often as the knees were flexed to a right angle or a little less he fell, and was unable to rise without assistance. There were complete ptosis and relaxation of the orbicularis, moderate dilatation of the pupils, double or multiple vision, unless he carefully rested his gaze on a near object, until the optic axes converged, and the eyes were meanwhile adapted to discern it clearly. The lower jaw had a slight tendency to hang, and the force of the masseters and temporals was barely sufficient to divide a piece of bread placed between the incisors—as the patient said: he "could not chew nor turn the food in his mouth." Deglutition was slow, painful, and imperfect, and the meal was laid aside until the end of the third or fourth hour. The effects came on a quarter of an hour after taking the medicine, and gradually increased in intensity until the end of the second or third hour, and then gradually declined and disappeared towards the end of the fifth hour. The effects were most severely felt on the left side, and remained longest in the muscles of the head. For a further account of this case see the Appendix to the paper.

Case 2.—*Intermittent spasm of the left sterno-mastoid and mass of muscles on the right side and back of the neck (spasmodic torticollis).*

The affection in this case is identical with that of the

former, less the spasm of the arm; and, like the former, the patient, John M—, æt. 40, is an industrious, temperate, and healthy man, muscularly strong, of dark complexion, and in the prime of life; weight 11 stone. He has never had any illness, and his children are healthy and free from nervous disorder. His occupation is brass-plate engraving; he works with chisel and mallet, and in order to maintain an oblique view of the plate at which he is working, the head is slightly raised and rotated to the right. He has had much domestic trouble during the last year, and has worked long hours.

He is conscious that the affection came on "with a feeling that the eyes were not quite parallel, and that he must needs twist his head farther round to the right in order to obtain an accurate view of the block." This feeling gradually increased until the head was distinctly twitched to the right.

The spasm rapidly increased and incapacitated him from work. It had existed six weeks when he came to me, at St. Thomas's Hospital, with the right hand upon the right side of the face, pushing the head round to the left. He said his arm was wearied with controlling the head, and yet he dared not withdraw it. He did so to satisfy me, and the face was immediately plucked round to the right shoulder, the head pulled backwards, and the chin forcibly tilted upwards as if he were going to fall backwards in a state of opisthotonos.

Treatment.—I at once gave him ʒj of the succus conii. It produced moderate coneism for an hour, but did not affect the spasm. I then prescribed from ʒx to ʒxij, according to the effect, twice a day; increased the dose to ʒij on the seventh day; to ʒiiss on the tenth day; to ʒiij on the thirteenth. He continued to take this dose twice a day as before until the twenty-third day, when it was increased to ʒiiiss twice a day and continued to the thirtieth day. After this, and up to the forty-sixth day, he took ʒiv of the juice twice a day, at 7.30 a.m. and 7.30 p.m. On the morning of this day (Dec. 9th), thinking, perhaps, that it would enable him to present a better appearance at the Medical and Chirurgical Society,

he took rather more than ʒv of the succus. My directions were seven tablespoonfuls, measured with a graduated glass, but he had used a large tablespoon which held ʒv when only moderately full. He had taken eight spoonfuls on the occasion referred to. He measured the dose for me with his spoon, and I found that it was little short of ʒvj. Since this time up to the seventieth day he regularly took ʒiv of the succus twice a day, at 7 a.m. and 7 p.m.

Effects of the conium.—For the same dose they were exactly those which were experienced by the first patient, the strength and activity of the two patients being pretty equal. But the ptosis was not quite so marked in this second case, while the weakness of the lower jaw was rather more so. The tongue was slightly affected, and there was a slowness and difficulty of articulation with a little thickness of speech. Speaking required a muscular effort, which was felt about the hyoid bone. ʒiv doses increased this difficulty, and on two or three occasions some seconds elapsed before he could exert sufficient muscular power to speak, and the voice at these times was very weak and gruff. The difficulty of deglutition was also increased, so that fluids tended to return by the nostrils. These effects on the tongue and gullet, which were associated with almost complete paralysis of the limbs, lasted for half an hour.

After the large dose taken at 7 a.m., on December 9th, the effects greatly alarmed his wife; he could neither speak nor move the legs for half an hour. The effects passed off as usual. He was able to walk to the hospital (a distance of a mile and a half) at 1 p.m. At 3 p.m. there was but feeble power in the lower jaw, and the orbicularis resisted but slightly. An hour afterwards the effects had wholly passed off. At 7 p.m. he walked three miles to the Medical and Chirurgical Society, and at 8.30 p.m. took ʒiij more, with a renewal of the effects in a more moderate degree.

Result.—On the seventh day he came into the prescribing-room with the head quiet and unsupported. The continuity of the spasm was broken, and he had long intervals of rest. Before he left the room he had one slight turn of the head,

and he said it came on a little when he was tired by walking, or if he was startled, and that there was a return to the former spasm in the morning before taking the hemlock.

The improvement continued without interruption. During the last six months he has remained well, with the exception of an occasional *tendency* to the old twist of the head when overtired. He has continued work, chiefly half time, during this period, and has passed through severe mental trials resulting from a tragic occurrence in a family who occupied part of his house. The hemlock was discontinued during the fourth month.

CASE 3.—*Chronic spasm of the extensors—chiefly the deltoid and triceps—of the right arm, and of the right pectoralis major.*

The patient, George L—, æt. 19, is a healthy young man, of regular and temperate habits. His occupation is that of a watchmaker, but he is unable to do ordinary fine work on account of the unsteadiness of the arm, which becomes strongly tremulous or jerky whenever he tries to keep it steady. It has been in this condition for five years. A year ago he was treated in one of the London hospitals during three months for "cramp in the arm." Galvanism was the chief remedy employed, but no benefit resulted. He came under my care nine months ago.

Treatment.—I treated him the first six weeks with conium, ℥vj of the succus once every day, and applied a blister once for pain in the shoulder. For the next ten weeks he took $\frac{1}{24}$ gr. strychnia twice a day, with an astringent chalybeate and mineral acid, and wore belladonna plaster over the deltoid. During the following six weeks he took from 10 to 20 grains of bromide of potassium thrice a day. For the following three weeks he took the juice of æthusa cynapium and the tincture of its fruit. None of the medicines, however, made the least impression on the spasm, and I therefore determined to try the effect of large doses of

conium. I gave ℥j at first, daily, and gradually increased the dose, so that at the end of five weeks he was taking ℥iiss. After another week I gave him three ounces for a dose every day, and he has continued it up to the present time, a period of forty days.

The effects of the hemlock in this case agreed exactly with those resulting from the same doses in Cases 1 and 2. The ptosis was nearly complete, and the relaxation of the orbicularis so complete that the eyelids appeared swollen.

The results.—While he was taking the full doses he was satisfied that there was a little diminution of the spasm; but I was unable to continue the treatment for want of an efficient juice, and the arm is now as unsteady as ever.

Case 4.—*Epilepsy and epileptic hemiplegia.*

Cordelia S—, an intelligent little girl, 4½ years old, was strong and well at two years of age, dentition was completed, and she spoke and walked well; but at this time she struck the left temple in a fall, and lay insensible for two minutes. Seven weeks afterwards she had a succession of convulsions with unconsciousness, lasting three hours. For the following three days the right arm was continuously convulsed, and for six months she was speechless. The fits recurred after an interval of five months from the first attack, and she had one every other day for two months. During the next four months she was free from fits, and suffered only from the partial hemiplegia of the right side. After this interval, in May of the present year, the fits recurred and were stronger than they were before, and during the next three months she had from two to nine fits, each lasting about two minutes, every day. They were always attended with loss of consciousness, and the palsied limbs were always most convulsed. Towards the end of this period, in July, 1873, she came under my care, at St. Thomas's. The muscular parts of the right limbs measured from an inch to an inch and a half less in circumference

than those of the left. The right arm hung powerless by her side; the protruded tongue deviated much to the left side. She was unable to walk or stand alone; the sleep was disturbed. She is a bright, intelligent child, and presents a slight scar on the left temple, which is the site of the blow.

Treatment.—I prescribed ʒij of the succus conii twice a day, increased it a week after to ʒiij, the following week to ʒiv twice a day; on the fifteenth day to ʒv, which she took twice a day for the next seven weeks. During the following three weeks she took ʒvj, for the next two months ℥j twice a day, and for another week ℥j once a day, and then, for two weeks longer, ℥j every other day.

Effects of the hemlock.—The small doses had a quieting effect, and the nocturnal restlessness disappeared. ʒv doses caused complete muscular relaxation, and she lay motionless for two hours, apparently "sleeping soundly" during the greater part of this time. As long as the lids remained open "the eyes were fixed and she seemed unconscious." As she grew stronger and recovered the use of the limbs, it was necessary to increase the dose rapidly, in order to produce inability to walk, and having become more active she was no longer observed to "sleep," but she would try to move about for a portion of the time during the action of the medicine, which was accompanied by both ptosis and squinting.

Result.—The fits rapidly declined in number and severity, and finally ceased during the fifth week of treatment, when she began to walk alone. In the ninth week she could raise the arm to the mouth, and a fortnight later above the head. Henceforward to the present time there has been uninterrupted improvement, and but for a halt on the right leg she walks firmly and well, presents her right hand on taking leave, and is regaining the use of the arm rapidly. She sleeps soundly, and her general health and strength have greatly improved. She remains free from any tendency to convulsion.

Such is the history of these cases up to the time when they were last presented to the Society. A further account of them is given in the Appendix.

General remarks on the nature and cause of the spasm in Cases 1, 2, *and* 3.

There is no doubt, in two of these, that the disordered movements were due to overwork. The nerve vesicles presiding over the affected muscles have been kept too long intent upon identical impressions; they have been maintained in an excited condition when there was need of rest, and the sustained muscular efforts have become weakened by overwork until the exaggerated nervous irritability has at last overcome the enfeebled will. It is exactly what occurs in the intellectual centres, where the same impressions may be so often repeated as to exclude change of thought and proper rest, resulting at last in a disturbance of the just balance of reason. In the direction those muscles were first taught, and subsequently compelled to go, in that direction they now continue to go automatically and in spite of the will. The first case of the kind that arrested my attention was that of a schoolmistress, who employed much of her time in ruling her pupils' copybooks, and in doing so rotated the head rhythmically, and with emphasis, from left to right. In her declining years she lost control over this movement, and the face was twisted every second to the right shoulder, unless her attention was strongly engaged in some other matter.

In the third case there is no evidence of overwork, nor must this be regarded as a necessary condition in the production of involuntary movements such as I have described. In a number of persons the nervous irritability is strong, and the will proportionately weak; and in these an over-anxious attention to execute certain movements is often sufficient to diminish their success, or even to secure their

failure. Nervous irritability in many, if not in most, cases gains strength from every succeeding embarrassment, and ultimately supplants the will. The young watchmaker furnishes, I think, an illustration of this. He is highly nervous although he does not know it, and cannot, therefore, acknowledge it. Steadiness of hand is essential to him, and I fear something has led him to mistrust his voluntary control. In other cases (4, for example) we must relieve the intelligence of any share in the disorder; not, however, forgetting that epilepsy itself is sometimes the effect of example, or even a creature of the imagination, and as such is, in both cases, presumably within the control of the will on the first uprise of emotion.

To revert to facts I would now very briefly direct your attention to the *surgical uses of hemlock*. If you examine the patients at the end of this meeting you will find complete relaxation of the whole muscular system, and the muscles of the head and face are apparently affected to a greater degree than those of the rest of the body.

The orbicularis is incapable of resistance. The movements of the eyeball are very sluggish, and there is more or less complete ptosis. The muscles of mastication and deglutition are nearly paralysed. Speech is slow and effected with exertion; the voice is gruff, from relaxation of the laryngeal muscles. Withal, the heart and breathing are normal; sensation and intelligence are perfect, and the mind is calm. The surgeon will infer from these facts the value of conium in trismus, in spasm of the orbicularis and of the gullet, and in dislocations of joints where the action of powerful muscles resists our efforts to reduce them. To the ophthalmic surgeon conium is ready to become a valuable assistant. It at once relieves, as if by magic, that powerful spasm of the orbicularis in keratitis which is caused by photophobia; and it is savage to talk of division of this

muscle as a preliminary to incisions of the eyeball. There is one operation in which it will prove a great boon, that is, the removal of artificial substances from the gullet. Accidents are occasionally happening with false teeth. It is both merciless and dangerous to attempt the removal of such bodies from the stomach or œsophagus without first removing the spasm which their presence excites, and at the same time relaxing the tube to facilitate their extraction. I will not enlarge on this topic. From the condition of general muscular relaxation produced by hemlock you will readily make your own inferences. I will, however, ask you to bear in mind one important fact, namely, that hemlock is totally destitute of anæsthesial properties, and that patients under its influence are able to help you by their efforts, and to guide you by their sensations.

Those who are unfamiliar with the action of hemlock will probably think that there is danger in using it as I have done to-night. I can say positively that there is none. The effects of hemlock are remarkably uniform, and the dose required is proportionate to the motor activity of the individual. In order to be explicit it may be desirable that I should indicate

The extent to which coneism may be carried.—I believe that the limits of safety are usually reached when deglutition is impeded, for here we trench on an involuntary act; but it may be carried thus far with perfect safety. (See Cases 1 and 2, where this effect has been induced day after day and twice a day for more than two months.) When the gullet is affected the speech is usually slow and thick, and the voice gruff from partial paralysis of the glossal and laryngeal muscles. In such cases the respiration is not appreciably affected; but when the coneism has passed off sighing is often an after effect, and a feeling of aching or oppression around the margin of the ribs, indicating a temporary depression of the respiratory function and weariness of the diaphragm. When the gullet is weakened we shall find the muscles of mastication and expression relaxed, the eyelids drooped and swollen, and the limbs incapable of supporting

the weight of the body. In women and inactive weakly persons the voluntary muscles are usually paralysed before the gullet or tongue is affected, and so they may lie incapable of movement, when the speech is free and deglutition easy. If there be any special weakness of a set of voluntary muscles, hemlock will be sure to point it out, and so it happens that in some cases the speech is affected by a dose which in others produces equal effects upon the muscles of the trunk, and yet does not affect the tongue at all. In some cases, *cæteris paribus,* ptosis and dilatation of the pupil are less marked than in others. While hemlock may therefore be used as a measure of the power of different sets of muscles, it is otherwise perfectly uniform in its action.

As to the *duration of the coneism.*—In cases of muscular spasm I have endeavoured to keep up the coneism as long as possible. The patients themselves often plead for this on account of the return of the spasm seven or eight hours after the coneism has passed off. The duration of the coneism is, of course, in proportion to the dose; the effect of an ounce of good succus in a healthy man will usually last about an hour; that of two ounces, from two to three hours; that of three ounces, from four to five hours; and that of four ounces, from seven to nine hours. Cases 1 and 2 are frequently under the influence of hemlock fourteen, and sometimes nineteen, out of the twenty-four hours.

I have been careful elsewhere ('Old Veg. Neurotics,' p. 348, and 'The Practitioner,' vol. v, p. 342) to point out that there is great variation in the strength of the succus conii, a variation which may be expected until the requirements of pharmacy are provided for by a better organisation, and the purity of drugs is secured by proper legislation. The juice used in the treatment of the above cases was most carefully selected. The doses mentioned have reference to a succus prepared according to the Pharmacopœia, but of a strength above the average of that preparation. I employed it for about nine months in the treatment of a great number of nervous disorders. A fluid ounce was sufficient to produce decided coneism in a strong man, while half an ounce was an

equivalent dose for a woman or a weakly man. The latter part of the treatment was interrupted by the exhaustion of the hospital stock of this juice; and before I obtained a supply from Mr. Buckle, who has prepared this juice for me from plants in a more advanced stage of development than those commonly employed, I was obliged to reject several samples of hemlock juice. Some had evidently been prepared from young succulent plants, and a dose of five or six ounces was needed to produce only a moderate effect; and some were inert and fraudulent preparations, of which the ordinary extract formed the basis.

APPENDIX.

The patient, W. H— (Case 1), remained under my care for some weeks after the preceding observations on his case were concluded. I continued the conium treatment, but owing to the difficulty and delay in procuring a succus of fair power, I was obliged to discharge him after a sojourn of nearly five months in the hospital. On leaving St. Thomas's he was admitted into Guy's Hospital, under the care of Dr. Frederick Taylor, who has kindly communicated to me the following observations. It will be seen that they agree with my own.

"W. H— was admitted on April 15th, and the following day he began the conium treatment, taking only a trial dose of two drachms. The dose was increased daily; no appreciable effect being obtained until the 20th, when two ounces produced very slight tingling of the legs, with slight relief of the spasm.

"On the 21st three ounces were given, and the eyelids drooped, and the legs became very weak; the spasm of the muscles was somewhat relieved.

"From 25th April to 2nd May he took five ounces at night (7 p.m.); this produced tingling and weakness of the feet and legs, weakness across the loins, drooping of the eyelids, inability to swallow, paralysis of the arms, with semiflexion of the fingers, and impaired vision, so that objects at a distance of ten or twelve feet looked misty, and at greater distances appeared double, treble, or even multiple.

"From May 2nd five and a half ounces; and from May 9th six ounces were ordered every night.

"From the 14th to the 23rd of May he took from four to five ounces of a fresh sample of the succus, morning and evening, with the same results. About the latter date, though acknowledging the great relief to the spasm, he complained much of general mental depression and a feeling of sinking about the stomach, which he attributed to the conium.

"The effect of the drug was decidedly favorable; the spasm was relaxed during the period immediately following the use of the medicine; quiet sleep was obtained; but as the time approached for taking another dose, the spasm again became troublesome. While he was taking the five-ounce doses the sterno-mastoid and the muscles acting on the right arm became almost entirely passive, so that he was enabled voluntarily to turn his face to the left, and to write letters with his right hand.

"After taking the juice in efficient doses for five weeks I discontinued it, to watch for the return of the spasm and to form an opinion as to ultimate cure. Before the expiration of a week the twitching movements were increasing, and as he was at that time unwilling to resume the conium on account of the peculiar mental depression which it caused, I ordered the continuous current to be applied daily. From this he obtained some relief, but he had at the same time a sleeping draught of hydrate of chloral. The conium was subsequently resumed in four-ounce doses nightly, the galvanism being continued at the same time. The first dose had a rapid and beneficial effect, giving him much more ease on the following morning.

"As a summary, I think one might say:—1. The effect

of a full dose in relieving the spasm and in procuring sleep and rest is very marked and beneficial. 2. That during the continuance of the treatment the slighter movements ceased, but others were only diminished. 3. That after five weeks' use of full doses, discontinuance was followed by increase of the contractions. 4. That the great mental depression produced in this patient by the frequent use of large doses will probably prevent their being used sufficiently long to enable one to form a reliable opinion on the curability of the affection by conium."

Dr. Taylor's conclusions from this case are exactly those which I should have deduced from my own observations, excepting that I would still regard it an open question whether we should not continue the treatment, with occasional intermissions, for a much longer time—for a period less disproportionate to the entire duration of the disease than one to twelve in such chronic cases.

The use of hemlock beyond the limits which I have prescribed would, I believe, be neither useful nor safe; and I have in this case, as well as some others, found it necessary occasionally to discontinue the use of the neurotic after the patient had been under its influence day after day, and week after week, for from twelve to eighteen hours out of the twenty-four. The sinking, powerless feeling referred to the epigastrium and hypochondria is due, I am satisfied, to depression of the phrenic centres, and to a weak, sluggish action of the diaphragm resulting therefrom. The mental depression is, I believe, but the consequence of this. Defective breathing necessarily depresses the vigour of the heart; and although this may not be outwardly manifest, it undoubtedly engenders in every case a feeling of mental depression.

July 25, 1874, Case 2.—The tendency to rotation of the head when tired, especially by walking, still continues, and the patient has gladly assented to my recommendation that he should have a complete rest from work and resume the

hemlock, with the view of removing this lingering trace of his distressing affection.

— Case 3.—This patient, having for some time continued other treatment, chiefly large doses of bromide of potassium, without the least improvement, is now about to resume hemlock.

— Case 4.—The conium was gradually discontinued, and the patient has had no medicine for the last four months. She has continued perfectly well and free from any tendency to convulsion; she has not much use of the hand, but the fingers are no longer contracted, and the muscles of the right limbs are nearly as plump as those of the left. The tongue still deviates strongly to the left.

The results of treatment in the foregoing cases are, therefore, most encouraging. Inveterate forms of spasm have been selected for two reasons :—1. To illustrate the general action and uses of conium; and 2, because, if it be proved that hemlock is curative or beneficial in the worst forms of these disorders, the inference is plain that the milder forms will more surely and readily yield to its power.

I would not, however, that any one should be misled by the supposition that *all* spasmodic affections—all cases of epilepsy, for example—are benefited by hemlock. There is much to be learnt in this direction; but, speaking generally, those spasmodic affections which may be expected to yield most readily to its influence have a cranial origin.

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THE PREPARATIONS OF CONIUM MACULATUM OF THE BRITISH PHARMACOPŒIA, 1864.

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In furnishing four preparations,—poultice, juice, tincture, and extract,—the *Conium maculatum* occupies a prominent position in the British Pharmacopœia. Yet, perhaps, there is no plant in any Materia Medica of whose medicinal value we have less assurance than of that of Hemlock. It is commonly reputed to be a very poisonous plant, and medical practitioners of the present day partake of this opinion, and prescribe it in very small doses.

The object of my inquiries is to ascertain how far this impression is correct, and at the same time to determine the medicinal value of its preparations more accurately than has yet been done.

I have occasionally prescribed the extract and tincture of the London Pharmacopœia in much larger doses than are usually given, but without effect. Negative results have been too uniformly present to allow me to attribute them, in every case, to carelessness in the manufacture or preservation of the particular drug used; and a very old impression that the potency of the plant is greatly exaggerated, has, for several years past, gained strength in my mind. Wishing to give the officinal preparations fair trial, I have long waited for an opportunity of getting the fresh, well-grown plant in its proper season, so that I might have a sound basis for my experiments.

On mentioning the subject to Mr. Hemingway, the distinguished pharmaceutical chemist, of Portman Street, Portman Square, he has most kindly relieved me of my chief difficulty, and while he has given me the benefit of a most cordial interest in the matter, he has provided me with most reliable means for conducting my experiments. The first object of my inquiries has been the—

Tinctura Conii fructûs.—The tincture with which the following observations were made, was most carefully prepared by Mr. Hemingway, in the early part of November last, under my own inspection. In investigations of this kind it is of fundamental importance to ascertain the characters of the materials employed and the processes adopted. I shall not scruple therefore to enter into a somewhat minute description of them.

Preparation of the Tincture.—Two ounces and a half of the powdered fruit,

mixed with fine sand, in order to separate the vegetable particles, and bring the spirit into more ready contact with them, were packed in the percolator, with a layer of sand above and below, the lower aperture of the percolator being closed with a piece of wash-leather. The fruit was then exhausted by the passage, drop by drop, and at a temperature of 62° F. of ʒxx of proof spirit. The percolation was preceded and occasionally interrupted by maceration,—the one process being substituted for the other by a slight rotation of the stopper. The supernatant spirit was preserved perfectly colourless by the upper layer of sand during the whole of the time, and thus fresh portions of pure spirit were constantly brought into contact with the separated fragments of the fruit. It is obvious that no more perfect process of exhaustion than this can be devised. It is one which Mr. Hemingway tells me he has constantly adopted in the preparation of tinctures, and it certainly appears desirable that such a thoroughly practical, cleanly, and effectual process should be universally prescribed for the preparation of this and similar pharmaceutical products.

The fruit used was a fine specimen, and probably of this year's growth. It was clean, and free from admixture with other umbelliferous fruits. The albumen was firm and solid, the commissure convex, the groove indicating the involution of the albumen broad and deep, and the crenations of the ridges well-formed—all of which I take to be essential characters of a well-matured fruit. My friend Professor Bentley has also examined the fruit and pronounced it mature and good. The powder was prepared by means of a fineish hair sieve, and *without the application of heat*. It evolved a strong heavy mousy odour.

When 14 ounces of the spirit had percolated, I collected f ʒss in a watch-glass, and allowed it to evaporate spontaneously. Only a slight yellowish-brown film of varnish remained upon the glass. The last six ounces of spirit came through colourless.

Mr. Hemingway exposed *the marc* to powerful pressure, and obtained about two ounces of colourless spirit rendered turbid by a little greyish feculent matter. On examining this fluid, I found that it contained minute spherules of a colourless fixed oil. After exposure to the light for a few days the oil assumed a bright sap-green colour. The whole was evaporated to dryness over a water-bath, and the oil separated from a minute portion of brown residue, by means of ether. *This fixed oil* was of an emerald-green colour, and possessed an odour resembling that of boiled linseed oil, and a nauseous rancid and bitter taste. It weighed 2 grains. I applied to the eye, and swallowed a drop of it without any result. Its specific gravity was less than that of proof spirit (0·920).

The following are the *characters of the tincture*:—Reaction slightly acid, colour light greenish-brown with an internal opalescence, a strong mousy odour. A mixture of f ʒss of the tincture and f ʒj of water was nearly colourless, but after exposure to light and air for twenty-four hours, it had assumed a leaf-green colour. This change is probably characteristic and depending upon a resinous matter allied to the green oil above described. It is no doubt one of a similar nature to that which affects guaiacum resin, but unlike this substance, neither the tincture nor the oil were rendered blue on exposure to protoxide of nitrogen.

In order to ascertain the physiological effects of the tincture, I selected two individuals,—a weakly emaciated woman, M. A. R—h, aged thirty-seven, and myself.

I began, November 11th, by taking f ʒss, and increased the dose f ʒss each day for the seven succeeding days, so that on November 18th I took f ʒiv, on the 19th I took f ʒv, and on the 20th f ʒvj. On the 21st I was called out of town, and was thus obliged to intermit my experiments for a few days. On the 28th of November I began again by taking f ʒvj. On each of the three following days I increased the dose by f ʒij, taking f ʒviij, f ʒx, and f ʒxij, on November 29th, 30th, and December 1st respectively. I did not take any

conium on the 2nd December; on the 3rd I swallowed f ʒij in Mr. Hemingway's presence.

The quantities above stated were taken in single doses, mixed with a little water, from 1½ to 2½ hours after breakfast. In order that the body should be well prepared for the poison, I took, most mornings, on getting out of bed, ʒj of bicarbonate of potash in a draught of water, sometimes alone, sometimes with a small proportion of tartaric acid. By this means the urine was preserved alkaline until late in the afternoon. The other mornings I purposely abstained from this or any other preparative measure.

I carefully looked for effects, but found none after any of the doses, excepting a stimulant action from the larger quantities of spirit. There was no disorder, nor diminution of muscular power. The pupil, definition in the vision of near and distant objects, the pulse and all the functions remained in their usual state, and the secretions were active and normal. During the whole of the time I was working harder and longer than usual, and sleeping less; nevertheless there was no sense of fatigue, neither drowsiness nor tendency to inaction. Every other day I was actively engaged with body and mind, and usually walked from four to seven miles. On the alternate day I remained quiet, and was chiefly employed in study. Immediately after taking the ʒij of tincture on the 3rd of December, I sat down and wrote my letters, and then entered upon some microscopical investigations, and continued them, with a single break of an hour, for eight hours consecutively. On this and other similar occasions I retired to bed without the feeling of mental fatigue which I frequently experience after prolonged microscopical work. It so happened, in fact, that at the time I was following my experiment upon the tincture of conium, I was in vigorous health, and this was in no way affected by the drug.

The other subject of my experiments was in a very different condition. She was a pale, delicate, emaciated woman, and confined to bed by the pain and constitutional disturbance attendant upon the formation of a very large abscess in the right loin. Her pulse was 108 and feeble, and she was restless and unable to sleep. The abscess was opened on November 13th, and a pint of pus discharged. The same night I ordered as an anodyne f ʒij of the tincture above described, and directed the dose to be increased each night, provided, as in my own case, no effects should follow. She slept well. On the following night f ʒiij were given, and there was no sleep. On the 18th she took f ʒss at night, but did not sleep well after it. On the 19th f ʒvij were given, and she had a good night's rest. Having used her supply, the conium was suspended for a few days, and opiates (♏xv to ♏xxx tincturæ opii) administered instead. Meanwhile the abscess was closing, the appetite returning, and the health rapidly improving. On December 1st she took f ʒj, and on the 2nd f ʒiss, which exhausted my supply. On carefully examining this woman from day to day, and with special reference to the effects of conium, neither Dr. Collie, one of the resident medical officers of the hospital, nor myself, could detect any result. Sleep followed some of the doses, but was, no doubt, totally independent of conium. Great relief followed the evacuation of the matter, and her health began to improve directly afterwards. She is now convalescent.

Examination of the Marc.—In order to make my experiments more satisfactory, I subjected the marc which Mr. Hemingway returned to me to the following process:—Placing it again in the percolator, I passed a solution of ʒj of caustic potash in f ʒviij of water through it, and subsequently washed it with water until it passed through colourless; f ʒxiv of dark brown fluid, resembling tincture of henbane in depth of colour, were thus procured. I subjected this to distillation, drop by drop, collecting the first ounce and a half separately. I allowed f ʒvij more to distil, and set this aside. I then put one-half of the marc (which had been exhausted by spirit and solution of potash) into the retort to

the remaining fluid, and distilled f ʒiv more. Having satisfied myself that these three fluids differed in no respect from each other, they were mixed, and presented the following physical and chemical characters, which are those of a dilute aqueous solution of conia:—Colourless at first, but becoming brown on exposure, a dirty-looking, greyish, flocculent scum of greasy matter floated upon its surface; odour rank and disagreeable, yet somewhat resembling elder-flowers; taste partook of the smell, it somewhat resembled hydrocyanic acid, and left a slight acrid impression. Reaction alkaline; nitric acid added to a few drops in a test-tube produced, after a few seconds, violent effervescence from the liberation of binoxide of nitrogen, and a yellow liquid resulted. When the action was moderated by spreading the fluids on a porcelain plate, a greenish-yellow or bright green turbidity appeared, and after a few minutes bubbles of binoxide of nitrogen began to form, and the evolution continued until the green colour was removed, and a faint yellowish fluid remained. Solution of nitrate of silver produced a dirty white curdy precipitate, which readily dissolved in ammonia. When dried and heated, a flame ran instantly through it; and on further heating the charred residue, only metallic silver remained. Solution of chloride of mercury caused an abundant white precipitate, which, when boiled with potash, became yellow and heavy, and evolved an alkaline vapour. When heated, the precipitate blackened, evolved mercurial vapours, and ultimately disappeared.

With solution of acetate of lead, the fluid gave a heavy drab-coloured precipitate. With sulphate of copper, a pale blue deposit. Both precipitates dissolved in dilute nitric acid, the former with effervescence.

This fluid was carefully preserved, and, on December 4th, I took f ʒss at 11 A.M., and f ʒj at 5 P.M. On December 5th, I took ʒii at 10.30 A.M., and ʒiij at 3.30 P.M. On the 6th, I took a single dose of f ʒvj. On the 7th, a single dose of f ʒx. On the 8th, a single dose of f ʒxij, and on the 9th a single dose of f ʒij. I then subjected the remainder to the same reagents as before, and found that the fluid possessed the same reactions as it did on the day I distilled it.

No effect followed any of the doses. After taking the last dose I walked across the square to church, and, during the early part of the service, thrice experienced, within as many minutes, a momentary fluttering in the cardiac region, such as precedes faintness, but I could not fairly attribute it to the conium, for I awoke with a headache and slight nausea, and these had not altogether subsided at the time when I experienced the above-mentioned sensation. Of this there was no repetition, the remainder of the headache passed off, and I was well and active during the rest of the day. During the prosecution of these experiments upon the tincture and the distillate from the marc, I abstained from alcoholic or other stimulants.

The result of these experiments goes far to prove that the tinctura conii fructûs recently introduced into our Pharmacopœia is, at least in all proper medicinal doses, an inert preparation. From Geiger's and Dr. Christison's experiments it appears that the fruit contains a larger quantity of conia than the other parts of the plant, but the fact that the green fruits contain a much larger proportion than the dry, seems to have been overlooked. We know that the active principle of the poppy is more abundant in the circulating juices of the green fruit than in any other part of the plant, and that the quantity contained in the fruit diminishes in proportion as it becomes hard and dry. It is very probable that this is the case with the conium, and that we must look for the greatest accumulation of its active principle in the green immature fruit. One question relative to the tincture still presents itself, viz. does alcohol possess an influence antagonistic to that of conium, and, if so, how great is that influence?

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THE PREPARATIONS OF CONIUM MACULATUM OF THE BRITISH PHARMACOPŒIA, 1864. & the tincture of the London Pharmacopœia

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In my former communication upon this subject I stated that the results of my experiments with the *Tinctura Conii fructûs* went far to prove that the preparation is practically an inert one. I may mention here that I have prescribed another specimen of this tincture in large doses with similarly negative results. I am informed by Mr. Hemingway that the fruit used in the preparation of the tincture employed in the experiments recorded in my former paper was grown near Prague; and that the whole of the conium fruit used in British pharmacy is obtained from Germany. Doubtless the German fruit is, to say the least, equally potent with that of British growth; and, as far as our present investigations are concerned, the use of the German fruit is the more appropriate, since it was most probably that employed by Geiger in his experiments. He states (Mag. für Pharm. xxxv.) that nine pounds of the dry ripe fruits yield one ounce of conia. Accordingly one ounce of the fruit should yield 3 grains of conia, and the quantity contained in f ʒxx of the tinctura conii fructus—assuming the fruit to be thoroughly exhausted of the alkaloid—would be $7\frac{1}{2}$ grains = to 0·375 in f ʒj. Now Continental physicians prescribe conia in doses of $\frac{1}{16}$th of a grain for a child, and $\frac{1}{4}$ to 1 drop for an adult.* Hence f ʒj of the tincture would be only a medium dose for an adult—assuming, as I have said, that it contain a quantity of conia equivalent to $\frac{1}{20}$th part of the fruit employed. It appears, therefore, that the quantity of fruit employed in the preparation of the tincture is much too small. But even if a much larger quantity were used, it is very doubtful whether the preparation would be an efficacious one, for two reasons:—1st, the active principle, although freely soluble in dilute spirit is effectually protected from its action by the horny albumen with which it is associated in the fruit,—a protection which is very inadequately removed by its comminution; and, secondly, it is very probable that a large dose of alcohol taken simultaneously with a small quantity of conia greatly

* Ann. de Thérap., 1853, p. 73; Archiv. Gén. 4e Sér xxiii. 226. See also Wood and Bache's Disp. United States Pharmacop. 11th ed. p. 295.

diminishes the effects of the latter, but of this I hope to furnish further evidence by-and-by.

In order to prove the quality of the fruit used in the tincture with which my experiments were made, I subjected one ounce avoirdupois to the following process for the extraction of conia. Having mixed it with an equal bulk of fine sand, I packed it loosely in the percolator, and passed, after previous maceration, alcoholic (spirit—containing 86·5 per cent. of alcohol—f ʒiv, water f ʒiij, caustic potash 60 grains) and aqueous (water f ʒij, caustic potash 60 grains) solutions of caustic potash through it, and subsequently alcohol, until it dropped through colourless. By this means, f ʒx of a turbid, brownish-green fluid, of the same depth of colour as the tincture of the leaf of the London Pharmacopœia, were obtained. This was exactly neutralized with sulphuric acid, and the sulphate of potash separated by filtration. The filtrate was placed in a retort, and the whole of the alcohol and the chief bulk of the water distilled off. These distillates were perfectly free, both from ammonia and conia, and also from sulphuric acid. About ʒiv of a blackish-brown syrupy fluid remained in the retort, and to this was added f ʒiv of aqueous solution of caustic potash, containing 16 grains of the alkali. The mixture was exposed to a temperature of 248° Fahr., by means of a chloride of calcium bath, and the distillation rapidly conducted. Colourless water and minute drops of equally colourless oily fluid passed over. About f ʒvj were obtained in all, and a charred black mass, which, when cold, evolved an intensely acrid and ammoniacal odour, remained in the retort. The distillate contained about 2 grains of conia, but I was unable to determine its exact weight, for it soon became opaquish, assumed a faint brownish tinge, and began to dissolve in the highly alkaline fluid upon which it floated. This latter assumed a brownish tinge. It possessed, but in a much greater degree, the reactions of the distillate from the marc of the tincture formerly described. It formed with iodine a colourless solution, and dissolved sulphur. When heated it became turbid and evolved the intensely acrid fumes of conia under the appearance of a white cloud. As the conia condensed again, it trickled in oily streaks down the sides of the tube. The presence of a little alcohol in the distillate doubtless rendered the conia soluble to this extent.

It appears very conclusively from this experiment that the fruit operated upon, and used in the preparation of the tincture, possesed the full amount of conia.

Before proceeding with my investigations of the remaining preparations of conium of the British Pharmacopœia, I have thought it desirable to ascertain the medicinal value of the tincture of the London Pharmacopœia, for which the tincture of the fruit has been substituted in the British Pharmacopœia. And this is the more necessary, since the dried leaf is still retained in the preparation of the poultice in our own Pharmacopœia, and it is also largely used in some other Pharmâcopœias, particularly in that of France.

I obtained two samples of the Tinctura Conii (P.L.): Messrs. J. Bell and Co. kindly furnished me with one, which I will call "Tincture No. 1;" and Mr. Hemingway prepared for my use another, which I will designate "Tincture No. 2." As I had in view a series of comparative experiments, with the tincture of the fruit, No. 2, was prepared in December last by exhausting, after eight days maceration in the percolator, ʒiiss of fine green, strongly smelling, dried leaf, (procured last June, and carefully preserved in a tin canister in a dry place), by the passage of f ʒxx of proof spirit. Thus its strength in comparison with the tincture of the P. L. was as 19 to 20; the London process yielding only f ʒxix out of the f ʒxx of spirit employed. No. 1 was prepared soon after the leaves were dried, and preserved from access of light. There was no apparent difference in the two preparations. Both possessed an acid reaction; a dark greenish-brown colour, a rank odour, and its corresponding flavour with a nauseous, bitterish taste. On admixture with water both became turbid from

the separation of a green resinous (?) matter. This was deposited on standing, and the faint yellowish-brown supernatant fluid apparently underwent no further change.

I began my experiments with Tincture No. 2:—

December 19, at 10·45 A.M., I took f ʒii, mixed with a little water, and remained quiet all day.

December 21, at 11·15 A.M., took f ʒiv, and remained quiet for five or six hours afterwards.

December 22, at 10·45 A.M., I took f ʒvj, and was afterwards and during the rest of the day actively engaged. Walked about five miles.

December 24, at 11 A.M., took f ʒj, and sat still conversing with patients for the hour following, and was afterwards actively engaged until midnight, when I retired to bed free from headache or fatigue. Next day I did not take the tincture.

December 26, awoke with a headache, and felt weak and poorly from broken rest, and a sharp attack of diarrhœa during the early morning. At noon I took f ʒx of the tincture, and immediately walked out a distance of three miles. No effects followed, neither was there any increase of the headache or sense of debility.

December 28, at 10·45, took ʒxiij of the tincture, and from half an hour to an hour and half afterwards experienced a slight stimulant effect.

I now began to use Tincture No. 1.

December 29, at 10·30 A.M., I took f ʒv.

December 30, at 10·30 A.M., f ʒvij, and sat quiet for an hour and half afterwards.

December 31, at 12·25 A.M., took f ʒix. I had previously been sitting in a cold room, and felt very cold, and my pulse was only 60. I pursued my writing at the same temperature, and three-quarters of an hour after taking the conium my pulse was 72, and had increased in force; the stimulant action of the alcohol was manifest.

January 1, at 10·45 A.M., I took f ʒxi.

January 3, at 10·30 A.M., took f ʒxiii.

January 4, at 11 A.M., I took *a mixture* of f ʒj of Tincture No. 1, and f ʒss of Tincture No. 2.

January 8, at noon, took f ʒj of No. 1 and f ʒvj of No. 2.

January 10, at 11·15 A.M. took f ʒj of each of the tinctures at a draught. I remained quiet. An hour after, the stimulant and diuretic effects of alcohol were fully manifest; the pulse was 76, the pupils normal. I was actively employed during the latter half of the day; worked a considerable time with the microscope, and did not retire to bed until midnight.

Beyond the above-mentioned stimulant and diuretic action, no effects whatever followed the use of the tincture. The quantities mentioned were mixed with an equal quantity of water, and taken at a single draught from an hour and half to three hours after breakfast, which consisted of a moderate quantity of coffee, or occasionally tea, and cold meat and bread.

Generally alcoholic and other stimulants were altogether avoided, the latter indeed altogether, and the former were never taken until at least six hours after the tincture. On only one occasion was an alkali taken, and all other medicines were avoided. During the whole of the time all the functions of body and mind were efficiently performed.

I gave these tinctures, in doses varying from f ʒiij to f ʒviij, in single doses to several of my patients during convalescence from acute disease, and on the day after they were allowed to leave their beds when they were very weak and tottering, but no other effect save that of stimulation from the spirit followed in any case.

78, *Upper Berkeley Street, January* 19, 1867.

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GENERAL OBSERVATIONS ON THE PREPARATIONS OF CONIUM, AND THE EXTRACTION OF CONIA.

BY JOHN HARLEY, M.D., F.L.S.

So much uncertainty attends the use of a particular class of old-established vegetable preparations, that few, doubtless, of those practitioners who frequently prescribe them, would be able to state accurately what effects would follow the exhibition of a given dose of them. I allude particularly to the preparations of the succulent vegetables, digitalis, henbane, and conium. Indeed, we cannot but feel convinced that, in respect of these, we are at present in almost total ignorance as to the relative medicinal value of the recent and dried plant. Nay, I believe I may go still further, and assert that we have, without sufficient experimental proof, attributed to the dried plant the virtues which cases of accidental poisoning, or more rarely direct experiment, have proved that the recent plant possesses.

These remarks apply very forcibly to Hemlock, and I shall avail myself of this opportunity, so courteously afforded to me by the Council, of calling the attention of the Society to a few practical points respecting the preparations of hemlock, which bear out the foregoing general assertions.

In some communications, lately made in the 'Pharmaceutical Journal,' I have shown that the tincture of the fruit of conium and the tincture of the dried leaf may be taken in such doses as to induce inconvenient effects from the alcohol contained in them; that, in fact, they are practically useless. In investigating a number of preparations prescribed for our use, it would be sufficient, as far as these are concerned, to show what are useless and what useful; but it is, at the same time, desirable to go a step further, and determine why a given preparation is useless.

Take, for example, the tincture of the dried leaf. It is inert; why? It may be that the dried herb contains none of the active principle of the recent plant. It may be that the alkaloid exists in undiminished quantity, but that its effects are destroyed by the action of the alcohol. To prove the point, I have carefully examined the sample of dried leaves used in the preparation of the tincture employed in my experiments. As I have, in a paper which has not yet appeared in the 'Pharmaceutical Journal,' described in detail the processes adopted, I will only mention here that I operated upon equal quantities of the dried leaf separated from the leafstalks, and of the leafstalks themselves; that both furnished an equal quantity of conia, and that this in each case did not amount to half a grain of impure conia from ʒij of the dried plant. In order

to separate so small a quantity of the active principle, I was led to adopt a process which I believe will be found to yield a larger quantity of conia than any other. Having prepared an aqueous or spirituous extract of the plant with as little heat as possible, and of a syrupy consistence, I mix it, while warm, with an equal bulk of strong solution of caustic potash (1 pint to 3 of water), and then transfer it to a long tube, and agitate the mixture with its bulk of æther several times during twenty-four hours. The æther is then decanted, and the alkaline mixture washed again and again with fresh portions of æther, until the conia is completely removed. Two, or at most three washings are sufficient for this purpose. On distillation of the æthereal solution the conia, more or less pure, according as spirit or water has been used for exhausting the herb, remains. The impure conia is next treated with diluted sulphuric acid, which separates the alkaloid from oily or resinous impurities. From this solution of sulphate of conia, the base is separated in the usual way, viz. evaporation to a syrupy consistence, mixture with caustic potash, washing the mixture with ether, evaporation of the ether, and distillation of the conia in a current of hydrogen. In the preparation of the extract, a small quantity of dilute sulphuric acid should be added to the tincture or infusion, in order to fix the conia before heat is applied.

I satisfied myself that æther will entirely remove the conia from an alkalized extract, by the following experiment:—I took f ʒiij of a dark brown mixture of extract and caustic potash, from which the conia had been completely removed by æther, and added to it a drop of conia dissolved in an excess of a dilute solution of sulphuric acid. After thorough admixture, it was set by for a few hours, and then, finding that it still contained an excess of caustic potash, it was mixed with one-third its bulk of æther, and agitated for two minutes. The æther was removed as soon as it was separated, and the mixture washed again with the same volume of æther, and decanted without delay. On evaporating the æthereal solutions, nearly the whole of the original drop of conia was recovered. In this case the process was hastily performed, and no pains taken to thoroughly wash the exhausted extract.

After making a number of comparative experiments of the above described method, and the usual mode of distillation with caustic potash, I find, as I have stated above, that the former is the most productive process when operating on small quantities. When strongly heated with caustic potash in the presence of organic matters, conia appears to undergo considerable decomposition. On examination of the retort remainder, after the distillation of the alkaline fluid containing the conia, I have separated by means of æther, a definite crystalline compound which, as it possesses a strong odour and taste of tobacco, is probably a derivative of conia. It appears distinct, both in physical and chemical characters, from conhydrin. As I have not yet completed my examination of it, I shall hope to say more about it in a future communication to the Journal. I call attention to it in this place, in order to elicit information respecting its relationship. A specimen lies upon the table.

Having thus, satisfactorily I hope, explained why the particular tinctures employed in my experiments were inert, I hope we shall all be led to the conclusion that the dried plant is wanting in the powers attributed to it, and that it should therefore be excluded from the Materia Medica. I would even apply this exclusion to the dried fruit, and would do so without hesitation, since, as I now proceed to show, we have in the *Succus conii* a most worthy representative of hemlock, and therefore a most valuable m dicine.

I have now made numerous experiments with this drug, supplied to me by Messrs. J. Bell and Co., Mr. Buckle, Mr. Hanbury, and Mr. Hemingway, but I need not do more than quote a passage from a communication which will, I hope, be published in the next number of the Journal. The *succus* is in every respect

so unobjectionable a preparation, and so long as it is carefully prepared, I venture to say we shall want no other, not even an extract.

In conclusion, I would say a few words by way of introducing to the notice of the Society a succus and an extract prepared by Mr. Hemingway from the fresh root. I am extremely sorry that severe indisposition prevents Mr. Hemingway from fulfilling his desire of being here to-night. He should properly have introduced these preparations to the Society, for their existence is entirely due to his interest in the question. Finding the spirituous preparations of the dried plant useless, we naturally directed our attention to the recent herb, and as the roots at this season of the year were alone to be obtained, Mr. Hemingway procured ten pounds, and Mr. Buckle most kindly gave us his valuable time and the use of his powerful hydraulic press, whereby the juice upon the table was obtained. The extract was prepared from a portion of the expressed juice the same day.

I find that these preparations contain a considerable amount of conia, but as I have not yet had time to complete my examination of them, nor opportunity of ascertaining their physiological effects, I must leave this matter also for subsequent consideration.

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ON THE PREPARATIONS OF CONIUM OF THE BRITISH PHARMACOPŒIA,

AND THE

TINCTURE OF THE LONDON PHARMACOPŒIA.

BY JOHN HARLEY, M.D. LOND., F.L.S.,

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In my last communication I gave an account of some experiments with two samples of the *tincture of the dried leaf*. The conclusion to be derived from them clearly coincides with that formed of the tincture of the fruit, viz. that it is practically an inert preparation.

As far as a *spirituous* preparation of the dried leaf is concerned, I think my experiments are conclusive. They entirely accord with my previous experience, which first led me to mistrust the preparation.

Feeling, however, that it is a matter of considerable importance to determine whether the dried plant does retain any active properties, and if so in what degree, I have carefully examined the dried leaves, from a portion of which the tinctures employed in my experiments were prepared. Excepting in the *poultice*, the dried leaf is no longer used in the British Pharmacopœia; but the importance of the investigation will be recognized when it is observed that the dried plant is largely used in some other Pharmacopœias. Looking first to our nearest neighbours, I find that the French Codex contains no less than six preparations of the dried leaf, viz.:—1. An alcoholic extract; 2. A plaster made of this extract; 3. An injection, composed of an infusion of the dried leaf; 4. Powder of the dry leaves; 5. An æthereal tincture; and lastly, 6. A tincture.

The Norwegian Pharmacopœia has two preparations of conium. 1. The dried leaf, prescribed as follows:—"medium dose, 2 to 3 grains; 10 grains would be a dangerous dose." 2. An aqueous extract of the dried leaf treated by alcohol, of which it is said:—"medium dose 1 to 2 grains; a dangerous dose, 6 grains."

There is scarcely a Continental Pharmacopœia which does not contain these and similar preparations of conium.

The 'United States Pharmacopœia' contains four preparations of conium, three of which are derived from the dried leaf:—1, an alcoholic extract; 2, a fluid extract; and, 3, a tincture corresponding to that of the London Pharmacopœia.

It is to be observed that the dried plant is thus extensively used notwithstanding that some very competent observers have expressed doubts respecting its activity. Geiger indeed expressly states* that the dried leaves of hemlock do not contain any conia, and Pereira says† "no reliance can be placed on the dried leaves however carefully prepared, for they sometimes yield no conia, though they possess the proper hemlock odour and a fine green colour." Of these two statements the latter is nearer the truth, but it implies—what I believe is untrue—that some dried hemlock leaves do possess the active properties commonly ascribed to them.

The following are my own observations upon this point:—

Examination of the dried leaves used in the preparation of the tincture above referred to.

I. February 11, 1867. Took one ounce avoirdupois of each of the two samples of leaves, separated from leaf-stalk and in coarse powder, and packed them in thin layers alternating with layers of fine sand in a percolator. f℥x of water containing 120 grains of caustic potash was poured upon them, and maceration allowed for 24 hours. The aqueous solution was then displaced by f℥viii of dilute alcohol (equal parts of rectified spirit and water), and maceration allowed for 24 hours more. The spirituous fluid was next displaced by water acidulated with sulphuric acid, and percolation continued as long as the running fluid possessed colour. f℥xxii of very dark greenish-brown fluid was thus obtained. A little more acid was added to produce exact neutralization of the alkali, and the turbid fluid filtered. Chlorophyl and sulphate of potash, destitute of conia or any of its salts, remained on the filter. The filtrate was evaporated over a water bath at a temperature under 160° F., until about ℥v of dark brown extract, of treacly consistence, remained. While still warm, this was rubbed up with f℥v of solution of caustic potash (1 part (HO, KO), 3 parts (H O)). A very faint odour of conia was evolved. The mixture was transferred to a long tube, and shaken at intervals with an equal bulk of æther. The æther assumed a yellowish-green colour. After 24 hours the æthereal solution was decanted, and the extract washed with fresh portions of æther as long as it continued to dissolve anything. The mixed æthereal solutions were then distilled. Half a grain of a clear, deep sap-green, thick, oily fluid, lighter than water, remained. It possessed a mint-like odour mixed with that of conia. To the tongue it was almost as bitingly acrid as conia itself, but in minute quantity it produced, like oil of peppermint, a sharp cooling sensation. Its taste was bitter, and it possessed, in an intense degree, the nauseous flavour of the dried leaf or its tincture. It was in fact a mixture of conia and the oleo-resin of the plant, coloured by chlorophyl. It imparted to water a strong alkaline reaction. Mixed with water acidulated with sulphuric acid it refused to dissolve, but the aqueous fluid obtained a tinge of colour, and, when evaporated nearly to dryness, a dark film of syrupy fluid remained, which, when mixed with a little solution of caustic potash, evolved a distinct odour of conia.

II. An ounce avoirdupois of the mixed leaves were taken and mixed with f℥vss of water and f℥ss dilute sulphuric acid P. B. Maceration was allowed for seven days at a temperature of 50° F. The fluid was then displaced by water. f℥x of bright sherry-coloured infusion was thus obtained. This

* Magazin für Pharmacie, xxxvi.

† Pereira, Elem. Materia Medica, vol. ii. part ii. p. 195.

was neutralized exactly by HO, KO, and filtered. A modification of chlorophyl, which gave a deep yellow colour with potash, and sulphate of potash, both free from conia or any of its salts, remained on the filter. The filtrate was treated as was that of No. 1, and the extract in like manner supersaturated with potash and washed with æther: a little less than half a grain of bright pale greenish-brown oily matter remained. It possessed a powerful odour, compounded of conia and the peculiar odour of the leaves with a minty addition. It smelt more of conia and less of mint than the product described under No. 1. Its taste was intensely biting, like that of conia itself, leaving a flavour of tobacco and peppermint, and the rank taste of the dried leaves. Treated with sulphuric acid the oily fluid partly dissolved, and the filtered solution manifested a purple tinge on evaporation, and furnished a little brown syrupy extract, which, upon the addition of potash, evolved a strong odour of conia, a distinct trace of which was obtained from the mixture by the aid of æther.

It appears from the foregoing experiments that the dried leaves do, when carefully prepared and preserved, retain a trace of conia; and it is equally conclusive that the quantity is much too small to furnish an efficient preparation.

III. In order to make my investigation complete, I subjected the leaf-stalks —primary, secondary, and tertiary—to the same process as that described in No. 1. Taking the same quantity of the leaf-stalks, viz. ʒii, I obtained as nearly as possible the same quantity of oily matter as from the leaves. Its physical and chemical properties were identically the same as those of the oily fluid obtained from the leaves.

It will be observed that I have not followed the usual process (that of distillation) for the extraction of conia in the above experiments. I have been induced to adopt the above method in order to prevent that decomposition of the alkaloid which takes place by prolonged heating with potash. If I had followed the prescribed processes, I should no doubt have been led to the same conclusion as Geiger, viz. that the dried leaves are destitute of conia.

I am now brought to the inquiry, What is the value of the *Cataplasma Conii*, P.B.? According to the most liberal computation it contains only half a grain of conia, and, as far as this principle is concerned, it may therefore be considered valueless. It is stated in Wood and Bache's 'Dispensatory of the United States' that two or three drops of conia may be given in the form of enema.

Succus Conii.—I now turn to another preparation of conium, the *Succus Conii*. This is, indeed, a most worthy representative of the famous hemlock, as I have most satisfactorily proved by its effect upon myself and others.

The drug with which I commenced my experiments was prepared by Mr. C. F. Buckle, of 77, Gray's Inn Road, W.C. He has kindly furnished me with the following particulars respecting the herb and the preparation of the juice:—

"June 1, 1866.—Received from Mr. Gaines 56 lbs. of *Conium maculatum* grown in Essex. The plants were fresh and fine, and just coming into bloom. The process of pulping between finely-grooved iron rollers was commenced at once; when complete, the pulp was subjected to the pressure of a very powerful hydraulic press, and 75 per cent. of juice obtained. This was immediately mixed with the proportion of spirit prescribed by the British Pharmacopœia, and the mixture set aside in a cellar. The whole of the process occupied ten hours, and was completed in one day. The mixture was subsequently filtered as directed, and bottled off." The resulting preparation was of a dark sherry-colour, possessed a delicate and agreeable herby taste and odour without acridity, and an acid reaction. Sp. g. 1002. fʒj

yielded 30 grs. of extract, and 0·42 grs. of pure conia. Heated with a little caustic potash, it evolved suffocating fumes of conia. Heat, alcohol, nitric acid, all precipitated albumen. The boiled and filtered juice gave reactions indicating the presence of sugar (in considerable quantity), soda, magnesia, lime, phosphoric acid (in considerable quantity), sulphuric acid (a minute proportion), chlorine. Bichloride of platinum gave a muddy molecular yellow deposit; tannic acid, a fine flocculent precipitate; perchloride of iron caused a precipitate, but neither the per- nor proto-salts produced any discoloration.

Dec. 10.—At 11.30 A.M. I took f℥ii with a little water. I remained quiet, and was engaged in close study all the rest of the day. No effect followed.

Dec. 11.—At 8.30 A.M. took ℥i of bicarbonate of potash in a large draught of water. At 10.30 A.M. took f℥iii of the succus, and went by railway into the City. On walking back again, about three-quarters of an hour after taking the conium, I suddenly felt a heavy clogging sensation in my heels, and as I went along I was satisfied that this was due to impairment of muscular power. After walking about a mile up-hill this sensation was very decided, and on putting a foot upon the scraper at the door of the hospital the other leg felt hardly sufficient to support me. It was a dark, foggy day, and I could not test my vision for distant objects with any certainty, but on looking at a blazing fire at the distant end of the ward I felt giddy, and I seemed to want power in my eyes in order to fix my gaze firmly enough to get a good definition. I could not follow the rapidly shifting flames so as to clearly define one from another. I felt clumsy in my movements. I was quite sure of them, but I felt that I needed to make an effort to control my legs. By the time I had finished my visit (1 P.M.) these effects had completely passed off, and I walked away briskly a distance of two miles. The maximum effect was manifest about an hour and a quarter after taking the hemlock.

Dec. 13, at 11 A.M.—Took f℥iii of succus, and experienced the above-mentioned effects in only a very slight degree. The pulse and pupils remained natural. I was pretty actively engaged the hour following the dose.

Dec. 15, at 10.15 A.M.—Took f℥iv and immediately walked a distance of three miles. Felt a repetition of the symptoms which I experienced on the 11th, after ℥iii of the juice. Three hours after taking the drug the symptoms had entirely passed off, and I felt as strong and active as I ever did.

Dec. 17, at 10.45 A.M.—Took f℥vss of the succus, having previously observed the pupils and the pulse, and continued moving about in a small room, arranging certain matters. I had forgotten the conium altogether, but was suddenly reminded of it by the occurrence of the following disorder of vision, which would, probably, be loosely called giddiness. It was what I might term voluntary giddiness,—a giddiness within my own control. So long as my eyes were fixed upon a given object, the definition and capacity of vision for the minutest objects were unimpaired; but the instant I directed the eyes to another object, all was haze and confusion, and, if standing, I felt giddy. As soon, however, as the eyes again rested upon an object, the confusion of vision and sense of giddiness instantly disappeared. It was clear to me that the adjusting muscular apparatus of the eye was enfeebled and its contractions so sluggishly performed, that they could no longer keep pace with those of the external muscles of the eye. Three-quarters of an hour after taking the conium this symptom suddenly appeared. At 11.45 (an hour after the dose) it was much increased: a general muscular lethargy affected me; the eyelids became so heavy that it required a considerable effort to raise them, and the implication of the third nerve was still further indicated by widely dilated pupils. I sat down to make these observations, and began to

feel so oppressed with rapidly increasing muscular lethargy, that I got up and tried to shake it off.

At 12, noon, I first felt weakness in my legs, and then, as these symptoms were rapidly increasing and my vision was very much puzzled, I felt some alarm; at the same time the earliest beginning of the sensations of squeamishness and faintness, which tobacco produces on those unaccustomed to its use, came on. I sat down again once or twice, but I was afraid of maintaining this posture, for I felt that it would so much encourage the lethargy that it might get the better of me. I therefore walked about and tested the muscular power of my legs. At this time I was cold, pale, and tottering. The pulse, which had been considerably excited by the sudden accession of the foregoing symptoms, was now sixty-eight and quite regular. The sensation of nausea soon passed off, but the diminution of muscular power increased, and I felt that if this continued, my legs would soon be unequal to support me. I could still go upstairs awkwardly, but the legs felt strangely light and powerless. The weakness was especially felt in the hamstring muscles. The mind remained perfectly clear and calm and the brain active, while the body seemed heavy and well-nigh asleep. There was, in fact, a direct diminution of power in all the voluntary muscles, almost amounting to paralysis; and of all the motor-nerves, the third was the earliest and most deeply implicated. The greatest exertion was at one time required to elevate the eyelids.

At 1.30 P.M.: pulse fifty-six; beginning to feel warmer; pupils less dilated; the heaviness of the eyelids and the voluntary giddiness diminishing; muscular power returning.

At 2.30 P.M.: all the symptoms had passed off. As in previous experiments, I totally abstained from all kinds of stimulants during the action of the medicine. At this time the urine was alkaline, from the effects of a dose of potash taken at 8.30 A.M. After luncheon I wrote letters till 4 P.M. and then walked briskly a distance of three miles. I abstained from stimulants all day, and finished the day's work by drawing a microscopic object.

A *second sample* of the Succus was obligingly sent to me by Messrs. Allen and Hanburys. Its sp. g. was 1015, the greater density being chiefly, if not altogether, due to the larger proportion of albumen and sugar. In all other respects the Succus corresponded with that already described.

Dec. 24.—N. P., a young woman of average health and strength, took f℥j. Excepting a slight feeling of nausea, no effect followed.

Dec. 27.—She took f℥j and ♏xl of the Succus. No effect followed.

Dec. 28.—She took f℥iij. Within half an hour, she became giddy and tottering. The muscular weakness increased, and during the next half-hour she was hardly able to walk. At the end of an hour the symptoms began to subside, and two hours and a half after taking the dose they had wholly passed off, leaving her in her usual health.

A *third sample* was kindly forwarded to me by Messrs. J. Bell and Co. The sp. g. of this preparation was intermediate between that of the first and second samples, viz. 1005. It contained less albumen than either. In all other respects it agreed with the other samples, and furnished the reactions above mentioned. It was prepared June 3, 1863.

Dec. 28.—N. D., a rather delicately-constituted young woman, took f℥ij of this Succus. No efforts followed, but she vomited an hour afterwards. This was probably due to other causes.

Dec. 29.—Took f℥iv. About twenty minutes afterwards she experienced nausea, and became giddy and unable to walk. An hour after taking the dose, there was nearly complete muscular paralysis, the eyelids were closed, and the pupils widely dilated. The mind was perfectly calm, clear, and ac-

tive, and she tried without success to raise her eyelids when I requested her to do so; the pulse and respiration were normal. The former had been accelerated at the outset of the symptoms. The surface was warm. The maximum effect was produced about an hour after taking the medicine. She remained in the state above described about three-quarters of an hour. The symptoms then subsided almost as rapidly as they came on, and three hours after taking the dose she was able to walk about as actively as ever, and attend to her duties. Next day, she complained of slight pain in the legs.

From the above investigations, it is conclusive that the Succus of the British Pharmacopœia possesses in an eminent degree the poisonous properties of the hemlock. The experiments with the third sample are peculiarly valuable, as they show that the preparation undergoes no change by keeping. Having thus distinguished the *Succus* from the inert tinctures, I trust that these will henceforth be excluded from the Pharmacopœias, and that medical practitioners will rely solely upon the Succus, which, in the compactness of the dose required, in the absence of any objectionable taste and odour, and in the potency and certainty of its operation, leaves nothing to be desired.

As a substitute for the *Cataplasma Conii*, P.B., a piece of lint saturated with the *Succus*, or, if heat and moisture be required, a bran poultice containing an ounce or an ounce and a half of the *Succus*, may be used.

78, *Upper Berkeley Street, W.*

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THE PREPARATIONS OF CONIUM OF THE BRITISH PHARMACOPŒIA, 1864 AND 1867.

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Extractum Conii.—Having completed my examination of the tinctures and succus, I come now to the consideration of the extract. Very few medicines have attained so great a reputation and have been so extensively employed as the extract of hemlock.

Introduced by Störck, in the year 1761, as a remedy of marvellous power in the removal of almost every inveterate disease to which the human frame is subject, it soon obtained admission into the Pharmacopœias; and, regarded as it is by practitioners of the present day as a powerful and useful remedy, it is still retained in almost every one of them. I myself have seen it prescribed almost daily, in doses varying from 1 to 5 grains, for the last twenty years. Nevertheless, it is to be observed that the efficacy of the extract has been questioned, and several times disproved, from the days of Störck down to our own times.

The following is the formula for the extract, to the agency of which Störck attributed his wonderful cures:—

"℞. Herbæ recentis cicutæ, quantum sufficiat. Exprimatur succus, isque recens lentissimo igne in vase terreo (sæpius agitando, ne amburatur) coquatur ad spissi extracti consistentiam, hoc extractum s. q. pulveris foliorum cicutæ in massam pilularem subigatur; ex qua fiant pilulæ granorum duorum."*

In some cases a few grains, taken daily for two or three weeks, were sufficient to remove, as it appeared, an old-standing disease, while in others the patient swallowed ʒii of the extract daily for four or five months without inconvenience. "The extract of hemlock," says Störck, "is a remedy absolutely innocent; it does not hurt the sight, but the contrary."

The following criticism, by an eminent contemporary of Störck, appears to me very just, and worthy of mention in this place:—

"Quin et incomprehensibile, ac plane paradoxon videtur, id statuisse. Præterquam enim quod nec in meis, nec in *Breslaviensium* pluribus, ea vis cicutæ confirmata fuerit, si consulam auctorem, qua namque dosi, a cicutæ extracto, hanc vim edi putet, video a granis 2 de die observasse eandem et sic porro a granis 4, ab 8, a 12, a 20, 30, 60, 120, 180, 240, idque haud rariore admodum casu sed frequenti.

* 'Essay on the Medicinal Use of Hemlock,' by A. Störck, 1761, p. 14.

"Si granum opii consuevit homini blandum conciliare, erunt alii qui indigeant dupla dosi, rariores qui triplo, quadruploque, rarissimi qui quintuplo, qui sextuplo uno die indigeant. Cicutæ autem dosis cur adeo immense augenda fit, ex comparatione cum ceteris paregoricis haud facile capitur."*

Störck's observations on the use of hemlock excited so much attention that his experiments were repeated in almost every country of Europe, and many of the leading practitioners of those times gave his far-famed extract ample trials. It needed but a short time to convince all observers that Störck had greatly overestimated its virtues. Not a few, however, were satisfied that it was a remedy of considerable value. Störck, Collin (*a*), Quarin (*b*), F. Hoffmann (*c*), Hill (*d*), Rouppe (*e*), Gataker (*f*), Andrée (*g*), W. Butter (*h*), Akenside (*h*), Spalowski (*i*), Burrows (*j*), have all advocated its use, and given us the result of their observations; but if we carefully examine their writings, we shall fail to recognise any mention of the least trace of those effects which distinguish the action of hemlock. I believe, therefore, that we are fully justified in concluding that the extract, whether prepared in Vienna, Amsterdam, Geneva, Naples, or in London, was practically, if not absolutely destitute of the active principle of the plant. Indeed, the impotency of the drug was occasionally recognized by some of these observers themselves, who attributed it to various causes,—the wrong plant had been used; the locality in which it had been grown, or the situation in which it had been exposed, was unsuitable for the elaboration of its juices; the herb had been gathered a month too soon or too late; the whole of the watery juice of the expressed herb had been used, whereas the first portions should have been rejected and only the latter and more resinous part employed. Dr. Butter, with a more correct appreciation of the real cause, cautions against the employment of too much heat in the preparation of the extract, and gives the following directions for its preparation:—Evaporate the freshly expressed juice in a broad glazed platter over a charcoal fire, and, as soon as green clots form, stir the liquor frequently, keeping it at such a heat as will make them move about without driving them above the surface or occasioning an ebullition. Evaporate with constant stirring till the extract is of sufficient consistence to form pills. Such directions, taken in conjunction with the precaution "*ne amburatur*," given in the previous formula, sufficiently indicate by what agency the powerful juice was reduced to an inert mass. As with the dried leaf, so with the extract, the active principle has departed and a dead inert body alone remains. The above mentioned authors introduce us to scores of patients who are taking the extract of hemlock largely. We look from one to another to discover some evidence—no matter how slight—of its action, but we search in vain; not a trace even of its earliest and most prominent effects are anywhere visible. We can hardly admit that these effects, evanescent though they be, could have been overlooked by such a body of intelligent observers. As scholars, at least, they were acquainted with the observations of Paulus Ægineta, Dioscorides, Plato, Galen, Plinius, respecting the action of hemlock; and, as scientific facts, these observations were repeatedly advanced in the discussions which the treatise of Störck excited in those days.†

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* 'Epistola de Cicuta,' Antonius de Haen, 1766, pp. 20, 21.

(*a*) Observ. circa Morbos Acutos, etc., 1765. (*b*) 'Tentamina de Cicuta,' 1761.

(*c*) Observ. on the Internal and External Use of Hemlock, 1764.

(*d*) Sir J. Hill, 'Directions for those Afflicted with Cancers, with account of the Vienna Hemlock,' 1771.

(*e*) De Morbis Navigantium; acced. de effectu extracti Cicutæ, etc., 1764.

(*f*) 'Essays on Medical Subjects,' 1764. (*g*) Obs. on Störck's Treatise, 1761.

(*h*) 'Treatise on Kinkcough, with an Appendix on Hemlock,' 1773. (*i*) 'De Cicuta,' 1777.

(*j*) Prac. Essay on Cancers, with method of Administering Hemlock, 1767.

† Bertrand, 'Recueil de Mémoires de Méd., de Chir., et de Pharm. Militaires,' 1ère sér. vol. ix. p. 313.

Passing by these earlier observers, I find the effects of hemlock practically indicated, for the first time, in the works of Dr. Fothergill. Speaking of a particular patient, he says, "The dose of hemlock (extract) was gradually increased from 20 to 70 grains a day; if he took more, it either made him sickish or created a singular kind of headache and giddiness."* These are, I think, real indications of the presence of hemlock. It must be observed, however, that the extract, used by Dr. Fothergill, was much more carefully prepared than that used by Störck and his contemporaries,—precautions having been taken both to collect the plant at the proper time, when the active principle is most abundant, and to avoid prolonged exposure of the juice to a high temperature.

A medical friend of Bertrand administered ʒj of carefully prepared extract, daily for a year, without result.† Dr. Allbutt, of Leeds, informs me that he 'has often given the extract, in doses so large as to nauseate by its mere mass, without other results."

It thus appears conclusively that, from the time of its introduction to the present day, the extract has been regarded by many as an uncertain preparation, and it is remarkable that its value has not been long ago more satisfactorily determined. Christison, Geiber, Orfila, Pereira, and others, all concur in the opinion that most of the extract of conium of the shops is inert or nearly so. Pereira states that he was unable to procure any sensible quantity of conia from ʒiv of the extract.‡ The observations on the extract are concluded in his work by the following statement, which is accepted, I believe, as a pharmaceutical axiom:—"The goodness of the extract may be determined by the disengagement of a strong odour of conia, when it is gradually triturated with liquor potassæ." This test is so readily applied, and appears at the same time so decisive, that any more elaborate analysis seems superfluous, and yet I venture to assert that no statement can be further from the truth, no test more fallacious. Half an ounce of extract, containing but a fraction of a grain of conia, will, on trituration with caustic potash, speedily evolve a powerful and penetrating odour of conia, and the effect is usually very much heightened by the simultaneous separation of a little ammonia. A great deal too much has been inferred from this reaction, and it is to this cause, I believe, that we have so long remained in a state of uncertainty respecting the virtue of the extract. A given sample has been pronounced good, because, on commixture with caustic potash, it has evolved a strong odour of conia. Attention to the following experiments will show the fallacy of such a conclusion.

I have already proved that the "succus conii" prepared last season by Mr. Buckle, of Gray's Inn Road, possesses in a powerful degree the poisonous properties of hemlock. As many sources of error are by this means eliminated, I am fortunate in being able to make two extracts, most carefully prepared from this succus, the basis of my investigations. One of these extracts was prepared strictly according to the directions given in the British Pharmacopœia, and contains, therefore, the albumen and chlorophyl of the juice,—this I shall call "ordinary extract." The other specimen was prepared by the same process, excepting that the colouring-matter, separated by exposing the juice to a temperature of 130° Fahr., was altogether rejected. This, therefore, I shall call "extract without chlorophyl." The evaporation of the juice in both cases was conducted at a temperature of about 160° Fahr.

Ordinary Extract of Conium of the British Pharmacopœia.—The following were the characters of this extract:—smooth, dull olive-green, of a consistence

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* De Haen, op. cit. Viventius J., 'De Cicuta,' Naples, 1777, which contains a very complete reference to the observations of the Ancients on the action of Hemlock.

† Obs. on the Use of Hemlock, John Fothergill, M.D., Works, vol. ii. p. 59.

‡ Elem. Mat. Med. vol. ii. pt. ii. p. 206.

sufficient for forming pills, taste acidulous, free from all bitterness and acridity, but partaking slightly of the nauseous oleo-resin of the plant. *Triturated with a little solution of caustic potash, a powerful odour, compounded of conia and ammonia, was evolved.*

1. January 22, 1867. Took 250 grains of this extract, and having liquefied it with a little water and f ʒiv of solution of caustic potash (1 part to 3 of water), thoroughly washed the mixture with separate portions of æther. After distillation of the æther, there remained 1·8 grain of a dark sap-green oily matter, which partly solidified after some hours. It possessed all the physical characters of the impure conia, obtained from the dried leaf by the agency of potash and alcohol (see examination of the dried leaf). Treated with dilute sulphuric acid, a portion dissolved, leaving a remainder of oleo-resin, coloured with chlorophyl. The acid solution contained nearly 1 grain of hydrated conia.

2. April 7, 1867. I took 10 grains of this extract.

April 10: 15 grains.

April 13. I licked-up 20 grains. Not the slightest effect followed any of these doses, although the conditions for their development were as favourable as could be desired.

I gave this extract in the same doses to two female patients; the one suffering from an ovarian tumour, the other from anæmic headache and dimness of sight. No effects followed its use, not even in the latter patient, who was already predisposed for its action.

Extract without the chlorophyl.—This was of the consistence of treacle, and had a similar bright and clear, but a richer amber-brown, colour; odour faintly approaching that of the ordinary extract, taste pleasantly sweet and acidulous, without any trace of acridity. *Triturated with caustic potash, a strong odour of conia, mixed with that of ammonia, is evolved.*

1. January 26, 1867. Took 250 grains, and having liquefied it with f ʒi solution of caustic potash (gr. 32 in f ʒi), transferred the mixture to a retort, and distilled from a chloride of calcium bath, at a temperature varying from 260° to 270° Fahr. 8¾ fluid drachms of colourless fluid, with a faint greasy film, passed over. f ʒv water, containing 50 grains of caustic potash, were now added to the contents of the retort, and distillation continued as long as alkaline fluid passed. ʒvi ss of fluid in all, was obtained. The conia was obtained from this by neutralization with sulphuric acid, evaporation, separation of the sulphate of ammonia, decomposition of the sulphate of conia with HOKO, and separation of the alkaloid by æther. It weighed only 0·2 of a grain.

2. By the process adopted in the separation of the conia from the ordinary extract (see above), I obtained from the same quantity (250 grs.) of this extract without chlorophyl exactly one grain of bright yellowish-brown oily fluid, which almost wholly dissolved in dilute sulphuric acid. It was, therefore, nearly pure conia.

3. February 13, 1867. I licked-up 5 grains of this extract. March 10. 10 grains. April 2: 15 grains. April 3: 20 grains. No effects followed either dose; nor could I obtain the slightest physiological action in the persons of two delicate women by giving the extract in the above-mentioned doses. To produce the slightest evidence of the presence of hemlock, 50 grains at least would have been required, but the doses were not further increased; for to be of any practical value, the extract should contain such a proportion of conia that its effects may be manifested after a dose of 10 or, at most, 20 grains.

It would not be fair, perhaps, to conclude from the foregoing experiments that all extract of conium is as deficient in medicinal power as the samples employed in these experiments have proved to be. Still, side by side with the facts referred to in this paper, they strongly persuade one to this view. The facts, indeed, of the particular case before us are very strong. The juice em-

ployed in the preparation of the extracts has been proved, both physiologically and chemically, to be replete in active properties,—f ʒj of the "Succus Conii" = f ʒvj of the juice of the plant, and 30 grains of extract, has been shown to contain 0·42 grains of conia; and every precaution was taken with the expressed juice to prevent decomposition by exposure to the air, to a high temperature, or to prolonged heat; and yet we find that 250 grains of it retain only a grain of the alkaloid. Again, two ounces of the dried leaf—equivalent to f ʒvj of the juice of the plant, and to very nearly 4 grains of conia—retain less than half a grain of the active principle. I say, then, that in face of these facts, there is a very strong body of evidence against the medicinal value of the extract.

With a view of determining what becomes of the conia during the process of evaporation, I have conducted the following experiments:—

1. Evaporated f ʒj of the Succus Conii, P. B., No. 1, over a water bath to the ordinary consistence of the extract. About an hour was required for the operation. After liberating the conia, and completely removing it, I found that it weighed 0·30 of a grain, 0·12 less than I obtained by the same process from the same quantity of the succus, to which I had previously added f ʒss of dilute sulphuric acid, P. B., in order to fix the conia.

2. Placed f ʒj of the same sample of "Succus Conii" in a retort, and distilled f ʒiiiss by the aid of a water bath. The distillation occupied three hours. The first f ʒiss passed over during the first fifteen minutes, and was collected separately. Excepting that the first fluid was chiefly spirit, the distillates did not appear to differ; both possessed a stronger odour of the plant than the succus itself; both gave out an extremely faint odour of conia on the addition of caustic potash, both were rendered faintly opalescent by the addition of nitrate of silver and of chloride of mercury. The remainder was transferred from the retort to an evaporating dish, and exposed to the heat of a water bath for another hour. The syrupy residue was then mixed with potash, and thoroughly washed with æther. 0·19 gr. of conia was obtained, being 0·11 gr. less than was obtained by the first experiment, and less than half of the quantity contained in the ounce of "succus."

3. Exposed f ʒj of the "Succus" upon a plate in a glass-house with a south aspect, and where the natural temperature ranged from 70° to 90° Fahr. After thirty-four hours the small syrupy residue was treated with potash and washed with æther; 0·25 of a grain of conia was obtained.

Two facts appear from these experiments—first, that the active principle of the plant is to a certain extent vaporizable even at a natural temperature of 70° to 90° Fahr.; and secondly, that prolonged exposure to a high temperature is accompanied by a progressive diminution of the conia, the alkaloid being converted, as Dr. Christison has pointed out, into ammonia and some other secondary product.

Now the quantity of juice prescribed by the Pharmacopœia for conversion into extract, is about eight gallons, and the prolonged exposure to a temperature ranging from 140° to 212° Fahr., required to effect this process, is doubtless sufficient to remove all but a trace of the active principle; and it is obvious from the foregoing that, given an efficient juice, the power of the extract will be inversely proportionate to the bulk of the juice operated upon; hence, to obtain an extract of full power, it will be necessary to expose the juice in a number of shallow dishes, and in a layer not exceeding half an inch in depth, to a rapid current of dry air having the temperature of 150° Fahr. or thereabouts, so that the whole may be reduced to the consistence of an extract in the course of two or three hours. By this means an extract, containing 1 per cent. of conia at most, may be procured. And it is extremely doubtful whether a stronger extract can be prepared by this or any other process.

Such are the conclusions to which the foregoing experiments lead, and in re-

spect of the use of the extract they are important. One fact is quite certain, viz. that the power of the extract has been greatly over-estimated. The present Pharmacopœia (1867) directs it to be given in doses of from 2 to 6 grains. Now, granting that this preparation retain the whole of the active principle, which, from my examination of the "Succus," I place at 1·4 grain in a 100 grains; 6 grains of the extract would represent only the 0·084 of a grain of conia,—a quantity insufficient to produce the effects of hemlock in a child two years old. The physiological action of hemlock is such, that doses which fall far short of producing it are of no use; and it is doubtful whether the possession of an extract containing 1 per cent. of conia—which I believe is the strongest that can be made—will be of any advantage, since 25 grains of it would be equivalent to only f ʒiv of the "*Succus*" of the Pharmacopœia.

It has been doubted by some whether the Athenian state-poison was wholly derived from the hemlock; I see no reason myself—on account of the expression "μικρὸν πάνυ καταπότιον, a very little dose"*—for doing so. The inspissation of the juice was effected, according to Dioscorides, by exposing it to the sun; and by this means a syrup may be prepared, of which, assuming the Greek plant to be equally powerful with that grown in these temperate regions, a tablespoonful or two would doubtless prove a fatal dose.

I will conclude these remarks by the following particulars, which will serve to render my account of the Succus Conii, No. 1, upon which I have chiefly based my experiments, more complete. f ʒj of the "*Succus*" yields six grains of white ash, which fuses with effervescence before the blow-pipe into a porcellaneous mass, dissolves with copious effervescence in the mineral acids, and the clear acid solution gives an abundant heavy yellow crystalline precipitate with bichloride of platinum. Hence it follows, that the juice contains one or more vegetable acids and potash.

It is to be observed that Schrader† makes no mention of either soda or sugar in his analysis of the juice, and that he, De Machy and Errhardt‡ mention nitric acid as one of its constituents. I have carefully examined the ash left by the combustion of the extract, and find myself in agreement with Bertrand and Baumé in being unable to discover a trace of nitrates.

Vapor Coniæ.—The use of the extract in the formation of the vapor is objectionable, for two reasons: first, the quantity of conia contained in the portion of mixture prescribed, is too small to relieve spasm; and, secondly, any influence which a minute portion of the alkaloid might possess, would probably be more than neutralized by the simultaneous evolution of ammonia from the alkalized extract.

In the following form these objections do not exist, and the dose of conia can be readily graduated:—

Conia, 1 grain.
Alcohol, 1½ fluid drachm. Dissolve the conia in ʒss of the alcohol, and add the remainder mixed with the water.
Water, 2½ fluid drachms.

20 minims contain $\frac{1}{12}$ of a grain of conia.

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* Theofrastos, Hist. Plant. iv. viii. p. 298, ed. Schneider.
† Berzelius, 'Traité de Chimie,' vol. vi. p. 254. Berlin. Jahrbuch, 1805, s. 152.
‡ Bertrand, op. cit. p. 306.

78, *Upper Berkeley St., W., April* 21, 1867.

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A CHEMICAL AND PHYSIOLOGICAL EXAMINATION OF THE ROOT OF THE HEMLOCK—CONIUM MACULATUM.

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All that is known of the root of the hemlock is contained in the following :—

(*a*) Theofrastos* says that in the case of other roots the juice is weaker than the fruit, but that of κώνειον is stronger, and rids a man of life easily and quickly when given as a potion in a very small quantity.

(*b*) "Two priests ate hemlock roots by mistake ; they became raving mad, and mistaking themselves for geese plunged into the water. For three years they suffered with partial palsy and violent pain."†

(*c*) A vinedresser and his wife ate hemlock roots by mistake for parsneps, and went to bed. They awoke in the middle of the night quite mad, and took to running about the house in the dark, bruising themselves severely against the walls. They recovered under suitable treatment.‡

(*d*) Störck makes the following extraordinary statement :—"The fresh root, when it is cut in pieces, emits a milk which is acrid and bitter to the taste. On rubbing a drop or two of it on the end of the tongue, it presently became stiff, swollen, and very painful, and soon afterwards I lost the power of speaking." Again, "If the powder of the root of hemlock be made into pills with a sufficient quantity of mucilage of gum tragacanth, a medicine is produced of great efficacy, but which requires great circumspection in the use of it."§

(*e*) Gmelin quotes an instance in which 4 ounces of the juice of the root were taken without injury. But the plant which furnished it does not appear to have been properly identified.‖

(*f*) On the 22nd April, Orfila gave 1½ ounce of the fresh root to a small dog.

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* Hist. Plant. IV. viii. p. 298, ed. Schneider.

† Kircher, Wimber, 'Wirkung der Arzneimittel und Gifte,' 1or. ii. 172. Pereira, Mat. Med., vol. ii. part ii. p. 201.

‡ Petri A. Matthioli 'Commentarii in sex libros Dioscoridis,' p. 736, ed. Venetiis, 1582. Gmelin's 'Pflanzengifte,' p. 604. Orfila, Toxicol. Gén., ii. p. 426, 4me édit. Christison, Trans. Roy. Soc. Edin., vol. xiii. p. 396.

§ A. Störck, 'Essay on the Medicinal Use of Hemlock,' pp. 8, 12. ‖ Op. cit. sec. 605.

No effect followed. The next day he introduced into the stomach of another dog 1 ounce of the same sample of the root, bruised, together with about 8 ounces of the fresh juice of the root. No effect followed.*

(*g*) Dr. Christison "found that 4½ ounces of the juice, the produce of 12 ounces of the roots collected in November, had no effect on a dog; and that 4 ounces obtained from 10 ounces of the roots in the middle of June, when the plant was coming into flower, merely caused diarrhœa and languor. The alcoholic extract of the juice obtained from 6 ounces of the roots, on the last day of May, killed a rabbit in 37 minutes, when introduced in a state of emulsion between the skin and muscles of the back, and the effects were analogous to those obtained with the extract of the leaves."†

With statements so conflicting as these, it seemed desirable that a careful examination of the root should be made at the season when it is in full vigour, and about to put forth its leaves.

In procuring for me a quantity of fine roots, and in providing me with a "succus" and an "extract" derived therefrom, Mr. Hemingway of Portman Street has given me every inducement to make such an investigation, and my obligations are due to him for affording me these and other facilities in the execution of my task.

The roots were removed from the ground on the 9th of January of the present year, during a short intermission of severe frost. They were large and well developed, many being more than two feet long, and, near the crown, an inch in diameter. They were all carefully examined and identified, and I have at this present time some fine plants of hemlock growing from a few of the roots, of the identity of which I was doubtful. With many, the young yellowish-green leaves were beginning to shoot from the crown, and here and there one could be found an inch long. These hemlock roots had the same sweet taste and pleasant flavour as the roots of the carrot, and, side by side, there was in this respect little to distinguish them. The hemlock roots were equally sweet, but the carrot roots had a stronger flavour. After chewing the hemlock root for a few seconds, a numbing sensation like that produced by pyrethrum, but milder, declared the difference. When bruised and in bulk, the hemlock root, moreover, had a rankish odour, approaching to that of the recent leaves.

The roots were well washed and set aside to drain, at a temperature of about 38° Fahr., and thirty-six hours after they were removed from the ground, and reduced to a coarse pulp by twice passing them between finely grooved iron rollers. The pulp was then placed in a number of horsehair bags, and subjected to a pressure of 110 tons, by means of a powerful hydraulic press. 9¾ pounds of the crushed root yielded 5½ pounds of juice, or about 56 per cent. The process was conducted at Mr. Buckle's establishment, 77, Gray's Inn Road, and I have to express my thanks to that gentleman for his kind help and hearty co-operation on this occasion. One portion of the juice was immediately converted, by the addition of one part of rectified spirit to every three parts of the juice, into a preparation corresponding to the succus conii of the British Pharmacopœia—a "succus conii radicis." A small portion of the crude juice was preserved for separate examination; the rest was at once carefully evaporated down to the consistence of an extract, at a temperature below 100° Fahr.

The Crude Juice.—The following are the characters of the crude juice:—A turbid brownish-white fluid, of sp. grav. 1022·8, having a decided acid reaction, a carrot odour, and sweet carrot taste, leaving a slight numbing sensation on the tongue. Heated with caustic potash it evolved an odour of conia, but not so strong as that from the juice of the leaves. After standing at a temperature of

* Orfila, 'Traité de Toxicologie,' 4me édit. ii. p. 423.
† Christison 'On Poisons,' 4th edit. p. 855

32° Fahr. for 36 hours the juice remained opalescent. On boiling, a cloud of albumen, equal, after standing 24 hours, to $\frac{1}{5}$ of the bulk of the fluid, separated. The supernatant fluid was bright and of a faint greenish-brown tinge. It gave reactions indicating the presence of a large quantity of *sugar;* of *chlorine; phosphoric acid* in abundance; *sulphuric acid*, a mere trace; *soda; lime;* and *magnesia.* f ℥j of the crude juice yielded 20 grains of extract; and this quantity of extract 1·3 grain of ash. The ash was with difficulty fusible, and refused to run into a compact porcellaneous mass, like that derived from the juice of the leaf. It dissolved with brisk effervescence in dilute hydrochloric acid. The solution contained abundance of *potash;* and a trace of iron, derived no doubt, from the rollers used in crushing the root. No trace of nitric acid could be detected.*

The extract was prepared from the crude juice, as I have stated. Fifty-five fluid ounces yielded $2\frac{1}{2}$ ounces avoir. (1093 grains). A very powerful hemlock odour was evolved during the whole of the process. The extract was chiefly composed of sugar, it was of a drab colour, possessed a faint odour, and very sweet saltish taste, otherwise resembling the extract of the leaf. 30 grains of it taken internally produced no effect, but the sensation of numbness before mentioned remained upon the tongue after swallowing it. It was excessively tenacious, and could be drawn out into long threads.

I. *January* 26, 1867.—Liquified 250 grains of the extract with a little water and f ℥j of solution of caustic potash (gr. xxxvj in f℥j), a strong odour of conia and ammonia was immediately evolved. The mixture was transferred to a retort, and distilled from a chloride of calcium bath at a temperature varying from 220° to 250° Fahr. A fluid ounce of highly alkaline colourless fluid was obtained. By Geiger's process 0·3 of a grain of oily matter, smelling strongly of conia, and $3\frac{1}{2}$ grains of nearly colourless sulphate of ammonia were obtained. Only a very slight darkening occurred during the process of evaporation of the neutralized distillate, but a very powerful acrid odour of conia was evolved on mixing the residue with caustic potash. After lying by in a corked tube for a few days, the conia product consolidated into stellate groups of almost colourless minute crystals; and when, after the lapse of three months, it was dissolved in æther the solution had a neutral reaction and a taste free from the biting acridity of conia. In fact it contained but a faint trace of conia, and appeared to be principally composed of one of the three substances about to be described.

A dark brown dry mass, evolving an intensely acrid odour somewhat resembling the empyreumatic oil of tobacco, remained in the retort. It was liquified with $1\frac{1}{2}$ ounce of water, and washed with a mixture of 1 part of chloroform and 5 parts of æther. After separation and distillation of the æthereal solution, a little clear brown fluid remained, and on allowing it to evaporate spontaneously a partly waxy and partly crystalline substance, of a rich brown colour, was obtained. I will call this the "æthereal extract;" it is composed of three distinct bodies—two crystalline neutral principles, and a resinous substance. As I find no mention of them in chemical works, I will briefly describe them under the names of rhizoconine, rhizoconylene, and conamarine, names which I use merely for the sake of distinction, and without any reference to the relationship of these bodies.

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* f ℥viij of the crude juice, heated to 150° Fahr. to precipitate the albumen, and filtered, were mixed with ♏xxx strong sulphuric acid, and set by. Five months afterwards the mixture was unchanged, and f ℥j was taken, mixed with a considerable excess of caustic potash, and twice washed with æther. After separation of the æther and its distillation, there remained less than half a grain of soft solid oily matter. It had a sharp minty tobacco taste, and a strong alkaline reaction. Stirred with a little dilute sulphuric acid it refused to dissolve, but on pouring off the acid and adding an excess of caustic potash to it, an odour of conia, as strong as that from a solution of a small drop of pure conia in four drachms of water, was evolved.

Rhizoconine is readily separated from the "æthereal extract" by means of alcohol. The residue obtained by evaporation of the alcoholic solution is treated with æther, which dissolves out the rhizoconine. It is easily soluble in alcohol, æther, and chloroform; the solutions are neutral to test paper. From alcohol and chloroform rhizoconine separates partly in the form of indistinct squarish crystalline masses, and partly as a soft waxy matter. From an æthereal solution it is deposited in the form of rich yellowish-brown radiating transparent prisms of considerable length, but of soft consistence. However obtained, it possesses a very diffusive, persistent, and slightly pungent odour, strongly resembling that of a dirty tobacco-pipe. Compared with nicotylia, the odour is heavier and somewhat peculiar. Its taste is at first slightly bitter and minty, but it soon becomes subacrid and tobacco-like, and leaves a slight but persistent numbing sensation upon the tongue. Without undergoing solution to any appreciable extent, it imparts to water and to the dilute mineral acids its characteristic taste. The aqueous solution is neutral, and gives no precipitate with either nitrate of silver, chloride of mercury, acetate of lead, or sulphate of copper. The strong mineral acids have no particular effect upon it: rubbed with strong sulphuric acid a dark brown muddy mixture results. It fuses at 160° Fahr. and above 500° gives off abundant white fumes of a disagreeable odour; it then chars and burns, leaving no ash. Boiled with solution of caustic potash, no alkaline vapours arise.

Rhizoconylene.—This is a colourless crystalline body, obtained from the "æthereal extract" by means of alcohol, which, dissolving out the rhizoconine and conamarine, leaves the rhizoconylene. It is insoluble in water and nearly so in cold alcohol, but at 175° Fahr. the latter takes up about $\frac{1}{30}$. It dissolves readily in both æther and chloroform, and separates from the former in long, dry, brilliant prisms, apparently possessing a rectangular base. From hot alcohol it is deposited in hard brilliant stellæ, composed of short but very sharply acuminated prisms. Its solutions are neutral, and it is destitute of taste and odour. In the cold, the strongest sulphuric, nitric, and hydrochloric acids have no action upon it. When boiled with solution of caustic potash, no alkaline fumes are evolved. The crystals melt at about 212° Fahr., and assume a brown colour. Above 600° Fahr. the fused mass is wholly dissipated into white fumes possessing a faint, somewhat fatty odour.

Conamarine.—When the "æthereal extract" is treated with alcohol, rhizoconine and conamarine are dissolved away, leaving the rhizoconylene. The alcoholic solution of the former is evaporated to dryness, and the two bodies separated by means of æther, which dissolves away the rhizoconine. Conamarine is an intensely bitter brownish-green resin, freely soluble in alcohol and chloroform, but wholly insoluble in æther. When heated with solution of caustic potash, it evolves an offensive odour like that of the urine of a carnivorous animal.

With this introduction, I must leave these substances to some one better qualified than myself to determine their composition and relationship. I thought at first that they were the products of the decomposition of conia at a high temperature in the presence of caustic potash and organic matters; but the following observations upon the extract of the root induce me to regard them now as natural constituents of the plant, related more closely perhaps to the oleoresin of the plant, than to its active principle.

II. Having liquified a portion of the extract of the root (described above), I washed it thoroughly with a mixture of æther and chloroform, and having separated the latter, distilled it from a hot water bath. A small quantity of light yellowish-brown oily matter of neutral reaction was obtained. It had a faint fatty non-characteristic odour, and a warm, slightly bitter, rancid taste. Heated with caustic potash it evolved no odour of conia. After the mixture

had been retained at a temperature of 212° Fah. for some minutes, it was shaken with ether. This dissolved out a little brown subcrystalline matter having a faint odour and taste of rhizoconine.

III. *April* 10, 1867.—250 grains of the same extract of the root were liquified with a little water, and f ʒiv of solution of caustic potash (1 part to 3 of water). The mixture was thoroughly washed with separate portions of æther, and the latter decanted. After distillation of the æther there remained 1·8 grain of light brown oily matter, which after standing-by for a few hours became in great part solid, from the formation of beautiful dendritic masses of crystals. It had a mixed odour of conia and tobacco, and an acrid cooling minty taste, becoming very bitter and tobacco-like. It contained but the faintest trace of conia, and was composed, like the "æthereal extract," from the retort remainder, and in about the same proportions, of rhizoconine, rhizoconylene, and conamarine,—the first of these bodies being, in both cases, the most abundant, and the last the least so. After separation of the conia and conamarine, the remainder (about 1 grain) was dissolved in a mixture of 15 minims of alcohol and 5 of æther, and injected beneath the skin of a cat. It produced no effect whatever.

IV. As it occurred to me that the conia might be stored up in the root in some insoluble combination, I took the whole of the roots from which the juice had been expressed, weighing now 4¼ pounds, and pulped them the same day with 30 ounces of hot water holding 4 ounces of caustic potash in solution. The whole of the house was filled with a very powerful and disagreeable mousy odour. The mixture was set aside for 24 hours. At the end of this time 17 fluid ounces of dark blackish-brown grumous fluid was obtained by pressure. It was distilled from a chloride of calcium bath, at a temperature between 218° and 220° Fahr., and 14½ ounces of clear colourless fluid were obtained. It presented a slight greasy film, was strongly alkaline, and had all the other physical and chemical characters of a mixed solution of ammonia and conia. By Geiger's process 15 grains of sulphate of ammonia and a small drop of nearly pure conia were separated from this distillate after neutralization with sulphuric acid.

From the foregoing observations it appears:—1. That as compared with the other parts of the plant, the root contains only a very small proportion of conia. 2. That in the careful preparation of an extract from the juice, this small quantity of conia is almost wholly lost. 3. That the root contains in addition to a bitter resin, two neutral bodies which, at a temperature between 220° and 250° Fahr., are capable of volatilization with water (see Experiment I.). 4. That these latter bodies do not appear to possess any active poisonous properties.

They exist in all other parts of the plant, although apparently in much smaller quantities than in the root, for I have obtained them from the retort remainder after the distillation of conia, both from the leaves and the fruit. In the latter case they were associated with conhydrin.

Rhizoconine is an interesting body, inasmuch as it resembles nicotylia in some of its physical characters. The slight acridity and carrot flavour of the root are undoubtedly due to this substance.

I come now to the prime object of my inquiries—the medicinal value of the root. Within an hour after the expression of the juice I took f ʒss of it without result. But a full answer to this inquiry will be found in the following experiments with the

Succus conii radicis prepared as above described. The mixture of crude juice and spirit deposited some dirty white albumen. The filtered product was quite clear, and of a delicate yellowish-brown tinge, and it completely retains the original odour and taste of the root at the present time.

April 21st, I took f ʒij of the "succus;" on the 26th, f ʒiv; May 2nd, f ʒvj, and set out walking; on the 10th of the same month I swallowed f ℥j of the "succus" and remained perfectly quiet, watching for some effect. None, however, followed this or any of the previous doses.

I subsequently gave a patient, a young man aged seventeen, whose general health was good, ʒj of the succus; and to another, a man of middle age, suffering from debility of the sexual organs, f ʒiss. No effects followed in either case.

With another patient I continued its use every alternate day, in doses increased from f ʒj to f ʒviij for some weeks, without any result.

It is conclusive, therefore, that in medicinal doses the root is quite inert. And it appears equally certain from the experiments of Christison and Orfila (*f* and *g*) that it is not poisonous, even when taken in such quantities as would supply the place of vegetables in an ordinary meal. No properly authenticated case of poisoning by hemlock root has been recorded; and the time has arrived, I think, when, in reference to a history of hemlock, such accounts as those given by Matthioli and Kircher (*b* and *c*), and so often adduced by medical authors, should be treated as mere fables. Such cases given, even with an understood "*valeant quantum valent*," do much more harm than good. In the present instance they have, probably more than any other cause, served to obscure and thus retard that clear knowledge of the physiological action of hemlock which I believe we now possess. As to Störck's statement (*d*), if it be not the effect of a greatly excited imagination, it must certainly be referred to some other plant, perhaps aconite. And yet such a statement, applied to the root of that plant, would still be an exaggeration.

78, *Upper Berkeley Street, W., May* 30, 1867.

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PREPARATIONS OF CONIUM.

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PREPARATIONS OF CONIUM; THEIR CHARACTERS AND RELATIVE MEDICINAL VALUE.

BY JOHN HARLEY, M.D. LOND., F.R.C.P., ETC.

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HAVING from time to time received, through the courtesy of their makers, certain preparations of hemlock, I have subjected them to examination with the view of determining their value, both intrinsically and as compared with the ordinary preparations. The results of this inquiry are now given with the view of assuring the medical practitioner—whose time is too fully occupied to allow him to determine such questions for himself—of the virtues of a given preparation of this valuable plant.

I must first premise that *the only reliable test of the amount of active principle in a preparation of hemlock is physiological action.* Chemical reagents, applied to the quantitative determination of conia in mixture with the ordinary constituents of vegetable infusions, give only the most fallacious results; and such a mode of estimating the amount of one of the most subtle and unstable of the vegetable alkaloids ought never more to be advocated.

To one acquainted with the physiological effects of conia, nothing is easier than to determine its amount by subjecting a nervous system of known power to its action. The experiment, moreover, is much more speedily performed than any chemical analysis, for an hour will usually suffice for the purpose.

Individuals of various age and nervous energy are the subjects of the following observations, and a view is at the same time afforded of the comparative susceptibility and the reverse of different individuals—or more restrictedly of different motor systems—to the influence of hemlock, which is of itself a very

interesting and instructive study in reference to the action of neurotic medicines.

Following my usual custom, I shall first describe the preparations in detail, and will commence with those of the fruit. I have already shown that conia stands to the ripe and unripe hemlock fruit pretty much in the same relation as opium does to the ripe and unripe fruit of the poppy. Conia abounds in the green pericarp, and gradually decreases as this hardens and becomes dry and brown. This does not quite agree with the following statements lately made by Schroff:[1]—1, that the unripe fruit of one-year conium plants contains the smallest amount of conia; 2, the unripe fruit of biennial plants contains the most conia, especially when the development of the fruit is advanced and near ripening; and 3, the perfectly ripe fruit, which is produced only by the biennial plants, stands in respect to efficacy between the former two. I think I have accumulated sufficient evidence to show that conium fruit differs somewhat in activity in different seasons; but I am convinced that annual plants will produce fruit as active as that of biennial ones, and of this I shall be able to adduce sufficient evidence, I believe, in the present communication. (See Cases 9, 13, 14, 15, and 16.) And as to the statement that biennial plants alone produce perfectly ripe fruit, I may say that I have kept up for the last four years a little plantation of annual hemlock plants derived from the self-sown seed of a previous generation of annual plants, so that I am at a loss to know what the Vienna professor can mean by this assertion.

1. *Extract of the Green Fruit.*—This was prepared by evaporating the tinctures (see below) to dryness over a water-bath. 1,000 grain measures yield 20 grains of bright yellowish brown brittle extract, which on exposure to the air becomes soft from the absorption of about 15 per cent. of water, and forms a translucent extract of the colour of Cape aloes; treated with excess of potash, it assumes a gamboge colour and evolves a powerful odour of conia.

2. *Fluid Extract of the Green Fruit.*—This is prepared by Edward R. Squibb, M.D., of Brooklyn, New York, a gentleman whose zeal and intelligence has been applied with much success

[1] Wochenblät. der K. K. Gesellschaft der Aerzte in Wien, 1870, No. 1.

to the advancement of pharmacy. The extract is a rich brown spirituous fluid of sp. gr. 0·992. *One minim represents one grain of the green undried fruit.* 1,000 grain measures yield 98 grains of extract, possessing the same physical characters as the preceding.

3. *Tincture of the Green Fruit.*—Two samples were used. The one, which I will distinguish as the "London tincture," was prepared by macerating the fresh undried crushed annual fruit in proof spirit and percolating (℥vj yielded ℥xxvj of tincture). The other was made according to the directions, and in the proportions for the tincture of the British Pharmacopœia, from dried American fruit sent to me by Dr. Manlius Smith (see "The Old Vegetable Neurotics," pp. 94 and 348). This, probably, is annual fruit also.

PREPARATIONS OF THE FRESH AND FLOWERING PLANT.

4. *Succus Conii* (P. B.).—This is a preparation which differs considerably in activity, the variability being due to the quantity of water contained in the plant (see "The Old Vegetable Neurotics," p. 349). The strength can be readily judged of by the depth of colour, which varies from that of pale sherry to dark Marsala wine—succus of the depth of colour of the latter will be thrice as strong as the palest variety. The juice used in the following observations represents two varieties: one intermediate in depth of colour, prepared, from year to year, by Mr. Buckle; and the other, the darkest and strongest, prepared in the unusually dry season of 1865, by Messrs. Allen and Hanburys. Both of these particular juices are fully described in my work (pp. 68 and 348).

5. *Extractum Conii* (P. B.).—I have already demonstrated[1] that 6 grains—the maximum dose—of this preparation cannot possibly contain more than the 0·084 of a grain of conia, a quantity insufficient to produce hemlock effects in a child two years old; and that 60 grains, at least, of the freshly and carefully prepared extract are required to produce slight effects in the active, and 15 or 20 at least in the most enfeebled adult. Even when the juice is spontaneously evaporated, as in the preparation of "Squire's extract," there is a progressive loss of conia, so that the extract contains no more than half the quan-

[1] Op. cit. p. 76 *et seq.*

tity that was contained in the juice. As it takes a long time to impress people with these facts, I will not omit this opportunity of showing the position which the extract occupies amongst the more active preparations of hemlock.

6. *Tincture of the Fresh Plant.*—Mr. Henry Deane, of Clapham Common, being desirous of ascertaining the relative efficacy of tinctures made, some from the fresh plant, and others from portions of the same parts dried and used immediately, has furnished me with these two varieties of tincture of conium. The plants used in this and the following preparation were in perfection, about half blown, and were gathered in the last week of June 1869. The tincture of the fresh plant was prepared by exhausting 32 ounces (avoird.) of the herb, previously crushed in a mill, with rectified spirit, until 53 fluid ounces of tincture were obtained (= nearly 5 drachms of the fresh plant in f. ℥j). At first it had a grass-green tinge, but became brownish on keeping; sp. gr. ·940; and 1,000 grain measures yield 36 grains of light yellowish brown extract, which absorbs 15 per cent. of water. During the evaporation a quantity of green resin separates.

PREPARATIONS OF THE DRIED PLANT.

7. *Tincture of the Dried Plant.*—The herb employed was a portion of that used in the previous preparation. It was dried by a natural heat in the open air, and used as soon as this was effected: 16 ounces of the fresh herb yielded 4 ounces of the dry. The tincture was prepared according to the directions of the P. L. 1851, *i.e.* in the proportion of 2½ ounces (avoird.) to 20 fluid ounces of rectified spirit (= 10 ounces of the fresh herb in the pint = ½ ounce in 1 ounce). It had and still retains a bright green tinge, and a quantity of vivid emerald green resin separates on evaporation. Sp. gr. ·940; 1,000 grain measures yield 32 grains of extract, possessing the same general characters as that last described, but being still more deliquescent, absorbing 25 per cent. of water.

8. *Fluid Extract of the Dried Leaves.*—This is made by Messrs. Clarke, Bleasdale, Bell & Co., of York. The herb used in the preparation was gathered in the neighbourhood of York at

midsummer 1868 (an exceptionally hot and dry season). The roughly-ground dried leaves were exhausted by percolation of proof spirit. The spirit was then distilled off, and the extract further evaporated until *one fluid drachm equalled one drachm of the dried leaves* = ½ ounce of fresh herb. It is a dark yellowish brown watery fluid of a rank hemlock odour, depositing much greenish brown resin on the sides of the bottle. 1,000 grain measures yield 195 grains of bright orange brown brittle extract, which rapidly absorbs water to the extent of 19 per cent.

9. *Benzoate of Conia.*—A member of a city firm of druggists lately deposited with me a solution labelled "Benzoate of conia: one drachm contains 2 grains; dose from 5 to 20 drops." I subsequently received from him samples of the solid substance. A dry salt of conia is a great desideratum, and I welcomed the preparation as a valuable addition to our Materia Medica. Failing, however, to find any mention of benzoate of conia in chemical works, and finding that I could not obtain any physiological effects in my own person and in others, even when the dose was increased to 20 *grains* of the solid substance, I was induced to give it a thorough examination. *The solution* is a spirituous, bright, straw-coloured fluid, of sp. gr. ·994·8, neutral, but of a warm sodaic taste; 1,000 grain measures yield 29·5 grains of residue identical with the solid substance. The mineral acids immediately, and acetic acid after an interval, precipitated abundance of benzoic acid. No conia odour was developed when either the solution itself or the acid fluids from which the benzoic acid had been precipitated, were supersaturated with potash. *The solid* is composed of granular masses of minute crystals of a dirty-straw colour, readily soluble in dilute spirit, and soluble, with slight effervescence, discoloration, and liberation of hydrochloric acid gas, in sulphuric acid. Neither heat nor excess of potash elicits the faintest odour of conia. At a high temperature it melts and blackens, emitting white fumes of benzoic acid, then boils and burns with a bright but smoky flame. After complete combustion 100 grains yield 47·2 grains of ash, which dissolves in dilute nitric acid, with brisk and prolonged effervescence; it is chiefly composed of soda, with some chloride of sodium, a little magnesia, and a trace of sulphuric acid. The reactions are in the main those of benzoate of soda;

and it appears, therefore, both from the absence of physiological effects and from the chemical analysis, that the so-called benzoate of conia is an impure benzoate of soda, and that it is devoid of a trace of conia.

When conia and benzoic acid, both in solution in dilute spirit, are mixed in equivalent proportions, the former is completely neutralised, and a solution of acid reaction and destitute of conia odour is formed. Evaporated, dried, and preserved over sulphuric acid, a clear and bright amber-coloured body of the consistence of soft extract remains. It has a faint conia odour and a bitter taste devoid of acridity, and forms with water an odourless solution. This is *neutral benzoate of conia;* the substance itself and its aqueous solution, even when a thousand times diluted, evolve the odour of conia when supersaturated with potash; and this occurs in presence of large quantities of either benzoic acid or benzoate of soda, proving that these bodies in no way interfere with the nasal test for conia. Heated in a test-tube, the benzoate runs, volatilizes, and decomposes with evolution of white fumes, in which the odour of benzoic acid is masked by the more powerful one of conia.

A *superbenzoate* was formed by the addition of two equivalents of the acid to one of conia; the resulting compound resembled the former, except that it was both colourless and odourless, and less readily soluble in water. Attempts to combine more of the acid, so as to produce a dry salt, failed. The reactions of the superbenzoate resembled those of the neutral salt.

Such are the preparations used in the following observations; let us now see what are their relative medicinal values. The patients have been selected on account of their familiarity with the intoxicating effects of hemlock. I have often observed that the same dose of a given preparation of hemlock has a variable effect upon the same patient. This observation is perhaps true in some degree of every drug and of every individual; but with respect to hemlock the variability is often very great. It is, I find, principally, if not altogether, due to two causes; viz. the degree of motor activity of the body, and the rapidity of absorption. With regard to the first of these causes, many persons are aware of a great difference in energy in the morning and evening,

before a meal and after it. Where languor or lack of energy is, there hemlock has a more marked effect. As to the second cause, the sensible effects of hemlock are very evanescent, and therefore when it is given on a full stomach absorption of the drug is often sufficiently delayed to prevent that rapidity of action which results in decided physiological effects. The action of the drug, moreover, is often weakened at the same time by the increase of liveliness and energy which are the immediate results of good digestion.

I have eliminated these interferences with the correct estimation of the value of the preparations employed: firstly, by giving the medicine in a particular case at the same hour of the day and at the same interval between meals; and secondly, by watching the effects of graduated doses, and as soon as an appreciable effect was induced, repeating the dose two, three, or more times.

The effects are briefly described as "slight," "moderate," and "full." The following is the value which I have given to these terms :—

Slight = haziness of vision and faint diminution of muscular power, rendering ordinary muscular exertion rather fatiguing. Duration about twenty minutes.

Moderate = mistiness of vision, a sensation of pressure upon the eyelids, distinct muscular weakness, especially referred to the hamstrings and muscles of the arms, with inability to walk fast. Duration from 30 to 45 minutes.

Full = confusion of vision, giddiness, tottering gait, extreme languor, and inability for continued muscular exertion, inducing the patient to sit or lie down and close the eyelids. Duration from 30 minutes to 1½ hours.

1. Anne B., æt. 27, a weakly, hysterical woman.

Extracti conii (P. B.) gr. xx repeatedly caused slight effects.

Succi conii (P. B., prepared by Buckle, 1866) f. ʒiij caused on several occasions full effects, with ptosis and partial paralysis of the arms and legs lasting half an hour.

Relative value—gr. xx extract = f. ʒij succus.

2. George G., æt. 24, a nervous, hypochondriacal young man. Took the extract or juice every second or third night for a period of four months.

Extracti conii (P. B., prepared by Messrs. Bell and Co., 1867 and 1868) gr. xl caused slight effects, and gr. lx moderate effects.

Succi conii (P. B., Buckle's, 1866 and 1867) f. ʒiv caused slight effects, and ʒvj moderate effects.

Relative value—gr. xl of extract invariably = f. ʒiv of the succus, and gr. lx of extract invariably = f. ʒvj of the succus.

3. Joseph B., æt. 44, the subject of paralysis agitans, and very weakly.

Extracti conii (P. B.) gr. xlv caused slight effects.

Succi conii (P. B.) ʒiv to ʒv caused slight, and ʒviij moderate effects.

Tincture of green fruit (American, ℥ivss of fruit yielding f. ʒx) ♏80 were required to produce a slight effect.

Relative value—gr. xlv of extract = ℥ivss of succus, and ♏80 of the tincture.

4. Mary P., æt. 50, a strong woman, afflicted with partial paralysis agitans.

Took 45 grains of fresh extractum conii (P. B., the same preparation as that used in Case 3) twice a day for several weeks, and at times ♏20 Squibb's fluid extract of the green fruit; but no physiological effects were ever produced by either preparation.

5. Emma G., æt. 15, the subject of chorea, a strong, well-developed girl. Took gr. xl extracti conii (P. B., the same preparation as that used in Cases 3 and 4) once, and latterly twice a day for several weeks, without experiencing the slightest appreciable effect.

6. Ann P., æt. 44, suffering from spinal atrophy and excessive debility. Required gr. xx of the same extractum conii to produce slight effects.

7. Benjamin O., æt. 30, affected with incomplete paraplegia. Required gr. xx extracti conii (P. B., Bell's, 1867, same as Case 2) to produce slight, and gr. xxv moderate effects.

8. George G., æt. 20, a rather weakly but active epileptic youth.

Succi conii (P. B., Buckle's, 1866) ʒiv induced slight symptoms = ℥ivss of the tincture of green fruit (American ℥iiss fruit to ʒxx).

9. Mary L., æt. 36, able-bodied, the subject of ovarian pain.
   Succi conii (P. B., Buckle's, 1866) ʒiv caused slight effects.
   Tincture of the green fruit (London, ℥v in ℥xx), ♏50 slight, ♏60 moderate, and ♏90 full effects.
10. John M., æt. 23, a delicate and nervous young man.
   Extracti conii (P. B., Bell's, 1868) gr. xl induced slight, and gr. lxxx full effects.
   Succi conii (P. B.) ʒiv taken in the morning fasting caused slight effects; in the evening, when he was more active, ʒv were required to produce the same effect.
   Relative value—40 grains of the extract = f. ʒiv of the juice.
11. George W., æt. 17, a robust epileptic youth.
   Succi conii (P. B., Buckle's, 1867. The plant yielded 75 per cent. of juice) ʒvj caused slight, and ʒix full effects.
   Succi conii (P. B., Allen and Hanbury's, 1865. The plant yielded about 35 per cent. of juice) ʒiij produced full effects.
   Relative value—ʒix of the one = ʒiij of the other.
12. Mr. E., æt. 19, a moderately strong young man.
   Extract of the green fruit (American) gr. iij: slight effects.
   Tincture of the green fruit (American, ℥iiss to ℥xx) ʒiv: slight effects.
   Succi conii (Buckle's, 1867) ʒiv slight, ʒvj moderate effects.
   Relative value—3 grains of the extract = f. ʒiv of the tincture = ʒiv of the juice.
13. John H., æt. 36, an active young man.
   Succi conii (P. B., Buckle's, 1860) ʒivss taken before breakfast induced moderate effects.
   Extract of the green fruit (London) gr. iij taken before breakfast produced equal effects.
14. William W., æt. 20, strong and healthy.
   Squibb's fluid extract ♏50 (= 50 grains fresh green fruit) caused slight, and ♏60 moderate effects.
   Tincture of the green fruit (London) ʒiss (= 23 grains fresh green fruit) induced slight, and ʒiij full effects.

Succi conii (B. P., Buckle, 1866) ʒiv (= half an ounce of fresh plant) caused slight, and ʒvj moderate effects.

Deane's tincture of the fresh plant ʒiiiss (= 2·1 drachms of fresh plant) caused slight, and ʒv moderate effects.

Deane's tincture of the dry plant ℥j caused slight, and ℥iss moderate effects.

Clarke and Co.'s fluid extract f. ʒiiiss (= 14 drachms of fresh plant) caused slight effects.

Relative value—♏50 Squibb's f. e. = ʒiss tincture green fruit = f. ʒv succus = ʒiiiss to ʒiv Deane's tincture of fresh plant = f. ℥j Deane's tincture of the dry plant = f. ʒiiiss of Clarke's fluid extract.

15. C. Jane L., æt. 8, a delicate but very active child.

Squibb's fluid extract ʒj : slight effects.

Succus conii (P. B., Buckle's, 1867) ʒvj : slight effects.

Succus conii (P. B., Allen and Hanbury's, 1865) ʒiiss moderate effects.

Tincture of the green fruit (London) ʒij : moderate effects.

Deane's tincture of the fresh plant ʒiv : slight effects.

Neutral benzoate of conia = 0·75 gr. conia : slight effects.

Relative value—ʒj Squibb's f. e. = ʒvj pale succus = ʒij of dark = ʒiss tincture of green fruit = ʒiv tincture of the fresh plant = ¾ gr. of conia neutralized with benzoic acid.

16. Alfred L., æt. 22, a healthy but nervous young man of moderate strength.

Squibb's fluid extract ♏40 induced slight effects.

Tincture of green fruit (London) ʒiss slight, ʒij moderate, and ʒiiss full effects.

Succus conii (P. B., Allen and Hanbury's, 1865, dark) ʒij slight, and ʒiij full effects.

Succus conii (P. B., Buckle's, 1866) ʒiv slight, and ʒvj moderate effects.

Deane's tincture of the fresh plant ʒiij to ʒiv slight effects.

Tincture of green fruit (American, ℥iiss to ℥xx) ʒiiiss slight effects.

Clarke's fluid extract ʒiiiss slight effects.

Relative value—Agrees closely with Case 14.

17. John J. H., æt. 20, a healthy young man of moderate strength.

Extract of the green fruit (American) gr. iij caused slight effects.

Squire's extract gr. lxx caused slight, and gr. lxxx moderate effects.

Squibb's fluid extract ʒj caused moderate effects.

Succus conii (P. B., Buckle's, 1867) ʒiv slight, and ʒvj moderate effects.

Deane's tincture of the fresh plant ʒiv slight, and ʒvj moderate effects.

Deane's tincture of the dry plant ʒviij caused slight effects.

Clarke's fluid extract ʒiij caused slight effects.

The comparative effects in this case agree very closely with those of Cases 14, 15, and 16.

18. Samuel M., æt. —, a robust man afflicted with neuralgia of the face.

Succus conii (P. B., Buckle's, 1867) ʒvj caused moderate effects.

Benzoate of conia = half grain of conia produced equal effects.

A sufficient number of instances having now been given to enable us to form a positive conclusion as to the relative efficacy of the several preparations of hemlock, and as the evidence requires no further analysis, I shall conclude this communication with such general remarks as the foregoing results necessarily suggest.

1. The advantage of the green fruit over every other part of the plant is so clear and decided, that nothing need be said in favour of its selection as the basis of the tincture and extract. The extract of the Pharmacopœia is a scandal to the present state of medical knowledge, and a spirituous extract of the green fruit ought as soon as possible to take its place; then indeed we shall have an extract of which the proper dose will be "from 2 to 6 grains," instead of from 20 to 60 grains or more, which is the efficient dose of the present extract.

2. The variability of the strength of the succus must prove a

serious drawback to its use, but this doubtless would be in great measure removed if hemlock were regularly cultivated for medicinal use in fixed localities. At present we are wholly dependent not only upon the wild plant, but upon the collectors, who, in order to be the first in the field, gather the plant as soon as it makes the least show of flowering, instead of allowing it to remain until the fruit begins to form, as is very properly directed in the British Pharmacopœia. Juice made from plants in this stage would have such activity that ʒij or ʒiv would be a powerful dose, whereas it is often necessary to give from one to three ounces or more of the watery succus prepared from the flowering plant; and this leads me to another matter, viz., the expensiveness of the succus, and I heartily second Mr. Berry's objections on this score.[1] Indeed I cannot do better than quote from a letter of a patient of mine. He says: "From the 4th of October till the end of the month I took the conium regularly every day, omitting a day now and then, and at the end of that time I had to take two and a half ounces to produce the desired effect, and my general and local health seemed much improved. From the remaining part of the term till December I took the medicine in doses varying from two and a half to three and a quarter ounces every three or four days. I took the conium in these large doses up to the end of January, and then I had to take nearly four ounces to produce the effect. . . . I can hardly afford to take the conium. Doses of three or four ounces are so frightfully expensive." This is a discredit to pharmacy, for hemlock is the rankest of our native weeds, and by an abundant yield of juice would well repay the room required for its growth —cultivation it requires none. If our pharmaceutists remain blind to their interests, medical men must help themselves, and annually rear a dozen plants in some waste spot of their garden. These will yield them a pound of green fruit, from which, with a very little trouble, may be made *a tincture* stronger than any juice that can be produced, and *an extract*, of which three grains would produce decided effects in most persons.

[1] See *The Practitioner*, vol. iii, p. 283.

ON THE

ACTION AND USE

OF THE

OPIUM ALKALOIDS CRYPTOPIA AND THEBAIA.

By JOHN HARLEY, M.D. Lond.

(*Reprinted from 'St. Thomas's Hospital Reports,' Vol. II.*)

Cryptopia.

The only observations on the physiological action of this alkaloid are those made by myself three or four years ago, and recorded in my work on 'The Old Vegetable Neurotics.'

A very limited supply of the substance prevented me at that time from extending my observations as far as I wished, but the renewed kindness and liberality of Messrs. T. and H. Smith, of Edinburgh, the discoverers of the alkaloid, have enabled me to advance them a step or two further.

The chemical characters of the alkaloid used in the following observations are those of the pure substance described at p. 165 of my work. It is there stated, on the authority of Messrs. Smith, that it exists in opium in the proportion of about one ounce to a ton; but these gentlemen have since informed me that they have succeeded in isolating it in double this proportion, and that there are grounds for inferring that a ton of opium contains at least four ounces of cryptopia, the percentage being probably equal to that of meconine, viz. 0·026. In the following observations, a solution of the alkaloid in water containing a slight excess of acetic acid was employed: 100 minims of the solution containing five grains of the pure alkaloid.

Physiological action.—This has been studied afresh on the dog, the cat, the rabbit, and on man.

On the Dog.—The effects of cryptopia on the dog vary like those of morphia, but not to the same extent, for they are always eminently characteristic. In one class of this animal—that in which morphia causes persistent nausea, faintness, and restlessness—cryptopia produces a most remarkable excitement of the voluntary movements, followed by somnolency. In the other class, that in which the hypnotic effect of morphia is readily induced to the exclusion of any notable derangement of the vagus, cryptopia still manifests its peculiar action, but the hypnotic and convellent effects are more equally balanced, and in some animals the former effect exceeds the latter and partially effaces it. Thus:

Obs. 1.—Injected beneath the skin of a young dog weighing twenty-one pounds, and in whom the subcutaneous use of half a grain of morphia induced complete narcotism for eight hours, one and a half grain of cryptopia. The operation frightened the dog, and after ten minutes he was dull and slobbered very much, clear glairy mucus dropping occasionally from his closed mouth. After thirty minutes, the first stage of excitement, the seemingly prying motions of the head were observable, but these soon subsided, and he lay down at my feet and remained very quiet during the next hour. Pulse 120 and regular, the pupils dilated, and clear mucus dropping continually from the mouth. He seemed in a dozy, dreamy condition. When disturbed at the end of the second hour, he followed me down stairs; ate food as usual at the third hour, and then lay down and slept tranquilly for several hours.

The effects of the same dose on a dog of the other class mainly consist in extraordinary vivacity of mind and body, marked by an interesting play of voluntary and involuntary movements. This condition is fully described in my work, and it is well illustrated in the following observations on the cat and rabbit, whence it will appear that the action of cryptopia on the dog, cat, and rabbit, and so far on carnivora and herbivora, is remarkably uniform.

On the Cat.—*Obs.* 2.—Injected half a grain of cryptopia beneath the skin of a young cat, A, weighing two pounds. After eighteen minutes she began to look about intently in front of the nose. After twenty minutes, pupils dilated; mouth and throat

uncomfortable, evidenced by licking the lips, and efforts of swallowing; walked slowly and naturally, looking pryingly about her. After thirty-five minutes, champing and swallowing, slobbering of tenacious mucus. After forty-five minutes, advanced very slowly, apparently impelled forwards, and yet holding back and moving with hesitating advance of the fore paw and frightened looks, only a step in a minute, as if she were walking on dangerous ground. This continued until the end of the second hour, when the pulse was 240, the pupils still dilated. Apparently about to advance, the body was swayed backwards and forwards, as she looked with a scared aspect from side to side, as if under the influence of some illusion; and thus she succeeded about once in ten minutes in advancing a pace forwards. At the fourth hour the slobbering had ceased, and she mewed in recognition of my call. Pulse 200; pupils contracting a little at the light. Half an hour afterwards she had quite recovered.

The experiment was repeated with another cat of the same age and family with exactly the same results, viz. slobbering of tenacious mucus; forward impulsive movements; dilated pupils. Heart beats from 260 to 280; respiration accelerated 80.

Obs. 3.—Injected three quarters of a grain cryptopia beneath the skin of a young cat weighing about three pounds. After five minutes, she suddenly started across the room in an awkward frightened manner, and began to lick the lips, and then became quiet. After fifteen minutes, characteristic effects came on and continued for the next three quarters of an hour; the fore legs were advanced, a little outspread and firmly set, and the head retracted and affected with rapid jerking movements backwards and forwards and from side to side. Now and then a fore paw was raised from the ground and twisted or shaken with spasm, and then the body while rigidly oscillating, as it seemed, between a forward and backward impulse, was thrown forwards in a nervous scramble. After a succession of such movements the animal got into a corner, and there continued to jerk the head about as if constantly avoiding a prick of the nose. When approached, she manifested first great nervousness, then anger, putting back her head and hissing at me, but after a little caressing she became more composed and seemed comforted; the choreic movements of the head and fore paws continued; the

respiratory movements were increased, and the pupils dilated to twice their initial size. Brought again into the centre of the room, she got back into the corner by a succession of the hesitating scrambling movements, the body being arrested as soon as the rush was made, by the rigid forward set of the fore legs. These spasmodic movements gradually declined, and ceased about an hour and a half after the injection, and the animal remained in the same corner during the next ten hours sleeping comfortably. At the end of this time she had taken neither food nor water, nor passed any excretions. Next day she was quite well and lively.

Obs. 4.—Injected one grain cryptopia beneath the skin of a young cat of the same family, age, and weight as A. She continued quiet, but, after ten minutes, strings of frothy tenacious mucus were hanging from the mouth, and she began looking attentively from side to side. After fifteen minutes, these symptoms continuing, the tail was extended, and curved upwards near the root; the body rigid and tremulous, apparently impelled forwards, and the impulse resisted or balanced by a rigid advance and set of the forelegs. While in this attitude a fore paw was occasionally raised slowly and supinated, and then advanced as if striking at a mouse. When the animal had maintained this constrained attitude for two minutes, she was suddenly hurled forwards, and rolled over and over in an opisthotonous convulsion, which lasted half a minute. As soon as the animal regained her legs she was impelled forwards in a succession of little convulsive leaps, first to the right and then to the left, the tail and ears erect, and the head rapidly jerked from side to side, the pupils dilated and the eyes staring. As, however, she constantly regained her legs, she seemed to be wildly scampering after a mouse. After twenty-two minutes she crept slowly and quietly along, with a stiff, awkward timid gait—the extended tail and erect ears being occasionally strongly twitched; mewing and answering when spoken to—and couched. While in this position, all the muscles were affected with intermittent spasm; now a hip was suddenly raised, nearly throwing the animal on her side; now the muscles along the back of the neck were violently worked; and now a fore arm was raised, the claws extended, and the limb shaken with spasm; one or other ear meanwhile was in a state of vibration. This continued to increase until the thirtieth minute, when she was thrown forwards

a second time, in a most violent tetanic spasm. It lasted but a second, and as the cat lay on the side the suspended respiration was re-established with slow and laboured inspirations, until they increased to seventy, and became regular; then the animal was for a few minutes free from spasm, and continued lying on her side looking about intelligently. At the fortieth minute the twitchings came on again, and the cat, having raised herself on the slightly-sprawling and floor-clutching legs, was alternately swayed backwards and forwards until the forty-seventh minute, when she was again thrown violently forwards in a third convulsion, in which all four legs were affected with most rapid movements. The attack lasted about fifteen seconds, and the breathing was recovered as before. The cat now seemed recovered, but exhausted, and she moved a length now and then when disturbed. At the fifty-second minute the spasm returned, in a milder degree; and at the fifty-fifth minute the body was raised on the haunches, the head and chest being curved forwards, and the fore paws incurved, and shaken for a few seconds with the most violent and rigid spasm. This over, the cat fell exhausted on her side, relaxed and apparently dead; the breathing, however, was restored by one or two laboured inspirations. At the sixtieth and sixty-second minutes, she had a fourth and fifth convulsion, the former lasting twenty seconds; in the interim the respirations were twenty, snatching and irregular. After the last attack she lay on her side breathing freely and deeply; but shortly afterwards she regained the couching position, with her fore legs a little sprawling, and, while in this position, and from this time up to the end of the fourth hour, the body was affected with constant choreic movements. These were at first so severe that the animal could not stand, and, as she lay along on the belly, the writhings of the muscles of the trunk moved the body half a circle from left to right in the course of half an hour. The abdominal muscles were strongly worked, and the head was extended and twisted in a wriggling manner by the spasm of the cervical muscles. The pupils were widely dilated throughout. During the earlier part of the choreic stage the respiration was twenty, irregular; the inspiration labored, and the expiration short and explosive; the heart's action weak and rapid. Towards the decline of the chorea the respiration increased to eighty, but continued

irregular; heart beats 260 and regular. The intelligence was apparently unimpaired throughout. From the fourth to the eighth hour the animal remained in a quiet dozy state, but passed no excretions from first to last. Next day she had quite recovered.

The effects of morphia on this animal in doses varying from $\frac{3}{10}$ths to $\frac{1}{2}$ grain, were delirium and restlessness with increased cardiac action and temperature, and complete and fixed dilatation of the pupils. Effects in fact precisely similar to those which follow the use of morphia in the horse.

On the Rabbit.—*Obs.* 5.—Injected two grains of cryptopia beneath the skin of an adult male rabbit, A. Immediately afterwards the respiration was 160 and panting, apparently from the excitement caused by the act of injection. He continued to hop and pry about the room actively and naturally until the seventh minute, when he erected an ear, and began to pant, and to hop round at short intervals. During the next few minutes the excitement increased; and, as he hopped sideways in a circle, the head was constantly advanced, and the nose rapidly worked with a sniffing motion, as if the animal was busy upon some object before its face. A fore paw was occasionally advanced as a preliminary to the hopping movement; the chest was contracted, and in vibration from rapid panting. After fifteen minutes, he began to slip forwards a little on the legs, the fore limbs being extended forwards, and seemingly exerted to prevent the advance. After half an hour, having continued in the same state, the head was now raised, and jerked backwards and forwards, the lips being separated each time the head was jerked backwards, and the animal was suddenly advanced a pace, as often the apparently voluntary resistance gave way to the involuntary impulse forwards; pupils widely dilated; respiration still a fine pant. After three quarters of an hour, the hind legs seemed weak, and the forward movement was more clumsily restrained. After one hour, heart beats 160; respiration still shallow and panting; pupils still dilated; restlessness decreased. From this time the symptoms slowly subsided, and after five hours from the injection, the animal leisurely ate a little green stuff. After six and a half hours he was in his usual condition, but as yet had not passed any excreta.

Obs. 6.—Injected, by four punctures, three and a quarter grains of cryptopia beneath the skin of another adult male rabbit, B. After fifteen minutes he was in the state of rabbit A (Obs. 5), at the same time. After twenty minutes the hind legs gave way, and the animal lay on the chest and belly, the head being rapidly jerked backwards and forwards, and from side to side. Occasionally the head was bent downwards, and the nose frequently tapped on the floor. After twenty-five minutes, lost the use of the fore legs; occasional spasm in the hind legs, slightly advancing the body; increased restlessness of the head; respiration 80, short, snatching, and somewhat irregular; pupils a little dilated. After thirty minutes, the jerkings and writhings of the head and neck increased, with very strong retractile action of the muscles of the neck, while the facial muscles, and especially those of the lips and vibrissæ, were powerfully convulsed. Five minutes later the muscles of the lower jaw were similarly implicated, the mouth being alternately opened and closed, with strong grinding of the teeth. The tongue was also convulsed. The animal now lay on the side, incapable of voluntary movement, the hind legs and hips flaccid, and the muscles of the face, head (excepting the orbicularis and muscles of the eyeball), chest, shoulders, and fore legs in a constant state of regularly intermittent spasm, the twitchings numbering fifty in the minute, and being synchronous with the inspirations. Heart's action meanwhile quite regular, and 140. The parts unaffected by spasm were not paralysed, for the hind leg was drawn up when touched, and the eyelids closed on attempting to approach the cornea. After one hour, the eyelids and hind legs were affected with spasmodic twitchings. Pupils of their initial dimension. The animal continued in this state until the end of the second hour, when the twitchings began to intermit, and give place to intervals of quiet of a few seconds duration. It had lately been impossible to count two successive inspirations, or even to distinguish the respiratory movements from the general twitchings of the muscles, but now five or six panting inspirations could be counted continuously. There was no apparent change in the circulation, and the body continued very warm. After two and a quarter hours the animal struggled to get on the belly, but was unable to retain this position until seven minutes later on, when he had just power

enough to maintain the couching posture. Heart beats 160; respiration 144, irregular, being sometimes accelerated to a quicker pant. The head alone was restless now.

From this time the symptoms rapidly passed off, and at the fifth hour the animal seemed to have quite recovered. Up to the seventh hour no excretions were passed.

Obs. 7.—Injected three and a half grains of cryptopia into the subcutaneous tissue of rabbit A. After forty minutes, one grain more, and one hour later another grain, making in all five and a half grains. Up to the forty-fifth minute the effects were precisely the same as those described in Obs. 5, the head being constantly twitched, the hind legs weakened and still, and the body slowly moved round in a circle from right to left by the spasms of the anterior part; the chest contracted, and the respiration reduced to a fine, rigid, irregular panting, numbering 160 a minute. During the second hour the symptoms were the same as those in Obs. 6, at that period of the operation of the drug; there was the same powerful grinding of the teeth and writhing of the tongue. The muscles of the eyeball and the orbicularis muscle escaped throughout, and the latter exhibited reflex movement up to the time of death. Half an hour after the third injection, the muscles of the face, neck, shoulders, and upper part of the chest were still affected with incessant twitchings, but the spasms were growing weaker, and the rest of the body was flaccid, and losing heat. Four hours after the first injection the spasmodic movements had become very weak, but not less frequent, and being now confined to the shoulders, neck, and head, the respirations could be counted; they were 50, and very faint; the heart beats 96, and feeble; the pupils dilated. The spasmodic movements became gradually weaker, until at last they were almost imperceptible, and then the animal was dead; this occurred four hours and twenty minutes after the first injection. At the moment of death the pupils contracted to their initial size, and the temperature of the rectum was 94° Fahr.

The body was opened ten minutes after death; the diaphragm was drawn up into the chest; the lungs collapsed, pale, and crepitant; the large veins at the roots full of dark blood. Both auricles were contracting synchronously and regularly 70. Shortly after the pericardium was opened, the ventricles began

to contract, and continued to do so regularly sixty times a minute.

The ventricular contractions chiefly affected the apex of the heart, the left side of the organ being twisted forwards to the right, and the apex at the same time drawn upwards towards the base, and flattened. These movements continued for fifteen minutes after opening the pericardium, and were independent of the withdrawal of blood from the heart. All four cavities of the heart, the pulmonary veins, and their branches in the lungs, as well as the venæ cavæ, were distended with dark venous blood, and it was clotted in the ventricles. The urinary bladder was full, and the stomach and intestines were filled with food and fæces.

On Man.—The main conclusions which, from a limited number of observations, I formed three years ago as to the action of cryptopia on man, were as follows:—1. The hypnotic effect is both considerable and protracted in those who are readily calmed by morphia, and that in this respect it is one fourth as powerful as morphia. 2. Although no unpleasant effects have followed its use in man, further experience is required to show that, as a hypnotic, it possesses any advantage over morphia.

Subsequent experience has confirmed me in the former of these conclusions, and with regard to the latter I am able to say that, as a gentle hypnotic, used subcutaneously, it does possess considerable advantages over morphia. In only one case has the subcutaneous use of the drug been attended by any unpleasant consequences, but even this does not properly form an exception. I give the case with the patient's statement, in order that my readers may form their own opinion. The other cases will serve to illustrate the general and particular effects of the drug.

Obs. 8.—James B—, æt. 55, a feeble, anæmic man, afflicted with general rheumatic neuralgia. Pulse 90, regular, of fair volume and power. Right pupil one eighth, left one ninth. Injected ♏xxiiss of solution of acetate=1½ grain of cryptopia, beneath the skin of the arm. After seventeen minutes, pulse 76, pupils unchanged; somnolency, but felt faint. After twenty-seven minutes, continued feeling of faintness, cold and pale; pulse 60, weak, regular. Gave him ʒj Spir. Ammon. co. in a draught of

water. Still sat quietly in the chair, and moaned occasionally when left alone. The faint feeling gradually passed off. After three quarters of an hour, pulse 60, weak and regular; respiration 30, regular; pupils unchanged; tongue natural; surface cold. After two hours, quite comfortable and dozing; pulse 58, regular, of initial volume and power; respiration 20; pupils unchanged; continued to doze comfortably for another hour and then walked home. I attributed the faintness to the action of the medicine, but the patient assured me it had nothing to do with it as he was liable to frequent attacks of the kind, and that they were occasionally of greater severity than the one I had witnessed. A week after, he reported himself as being free from pain.

Obs. 9.—Thomas W—, æt. 31, a strong man affected with right facial neuralgia. Pulse 88, tongue moist; pupils, the right $\frac{1}{7}$th, the left $\frac{1}{6}$th.[1] Injected into the subcutaneous tissue of the arm ♏xxiiss of solution of acetate = 1½ grain cryptopia. After twenty minutes, decided dilatation of the pupils, and somnolency. After thirty minutes, pulse 84, tongue unchanged; pupils, right one sixth, left one fifth; considerable somnolency. Went home and slept soundly for some hours. After a week he reported that the tic passed off under the influence of the cryptopia, and had not reappeared. This was five weeks ago, and as he has not reappeared amongst my out-patients I conclude that the relief has been thus far permanent.

Obs. 10.—Charles H—, æt. 18. Insomnia, fifth day of typhus. Pulse 100; respiration 24; pupils one seventh; tongue clean, dry, and glazed. Injected solution of acetate = to 1½ grain cryptopia, into the subcutaneous tissue of the arm. After twenty minutes, pulse 96; respiration 26; pupils and tongue unchanged; inclined for sleep. After one hour and a half, had slept comfortably since last seen. Pulse 96, increased in volume and power; respiration, sleeping 36, waking 30. Pupils dilated as he slept, on waking, one fourth; felt quite comfortable. After two hours, was still sleeping; pulse 96; respiration, sleeping 40, awake 36. After three hours, still sleeping; respiration 40 sleeping, awake 36; pulse 100. Five hours after the injection, passed f℥xvj of dark brownish acid urine like maltwort, sp. gr. 1027·2; on standing it deposited a quarter of its volume of stone-coloured fluffy amorphous deposit, soluble in ammonia. The clear urine had

[1] See Obs. 15, *et seq.*

a peculiar glaucous-brown colour; it contained a large excess of lithic acid.

After an interval of three days the injection of 1½ grain cryptopia was repeated, the pulse being 100, respiration 36, and the pupils one seventh. After thirty-five minutes, pulse 98, respiration 36, pupils one sixth; a troublesome cough had prevented sleep. After one hour, pulse 100, respiration 40; sweating moderately, and was comfortable and inclined for sleep. After two and a quarter hours, slept since last seen; pulse 100, respiration 40, pupils one sixth. Five hours after the injection, passed f ℥vij of normally acid urine, sp. gr. 1022, of the same peculiarly yellowish- or greenish-brown colour, quite bright and free from deposits.

Obs. 11.—Injected solution of the acetate in doses varying from 1 to 1½ grains, beneath the skin of a weakly man of middle age who had suffered long and severely from sciatica. The anodyne effect of the drug was immediate, marked, and enduring. As a hypnotic the result of its action was most satisfactory. Somnolency came on about ten minutes after the injection and continued for five or six hours; the sleep was tranquil and undisturbed by dreams. Dilatation of the pupil was a marked effect in this case.

Elimination.—The urine excreted after the action of cryptopia, in the cases in which I have had an opportunity of examining it, has possessed a peculiar yellowish- or greenish-brown tinge by transmitted light. This was the condition in Obs. 7 and 10. On opening the bladder of the rabbit I found the urine crowded with white pyriform bodies, about half the size of a grain of wheat, and of faint outline and gelatinous appearance, but quite distinct and of equal size. Searching as I was for Bilharzia (having fed the animal on the eggs of the parasite), my first thought was that they might be a brood of minute flukes. This idea, however, was not long tenable, and my second conjecture, remembering the remarkable way in which narceine is separated from the blood in the kidney, was that the bodies were jelly-like masses of cryptopia, as they had been dropped from the orifices of the tubules into the calyces of the kidney. This led me to examine the urine for cryptopia. I collected a portion of the jelly-like bodies on a filter, and washed them free from urine, and, having dried the filter, boiled it in absolute alcohol to abstract any cryptopia. The hot alcohol

filtrate was allowed to evaporate spontaneously in a watch-glass. A stain remained, composed at the margin of a few minute scattered prisms. On causing sulphuric acid to flow over the stain, a rich violet colour was developed, and on heating the fluid it became slate coloured, thick, and opaque. The other portion of urine was treated, first with acetic acid, which dissolved the gelatinous bodies, and then with ammonia to neutralization. The deposit thus obtained, composed chiefly of phosphates, was washed and exhausted with alcohol. The stain left by evaporation also gave a violet colour. Hence I think it may be inferred that a minute quantity of cryptopia was present in the urine; but the jelly-like masses could scarcely have been wholly composed of this substance, for in this case the quantity obtained would have been greater; probably they were formed by the deposit of phosphates, in the most delicate gelatinous film of cryptopia. I examined the urines obtained in Obs. 10 in a similar way, and, by means of hot chloroform, obtained from the deposit of washed phosphates a filmy residue; but this developed only a reddish-brown colour with sulphuric acid, becoming darker on the application of heat.

Conclusions.—Taking now a general review of the action of cryptopia, we cannot fail to see that in its effects on the nervous system it stands exactly midway between morphia and thebaia, sharing equally in the qualities of both. We have applied the test of different nervous systems to the substance, and found that those of the mouse, of some dogs, and of man, give sleep, while those of other dogs, of the cat, and of the rabbit, give convulsion. A grand physiological truth lies here, for surely these experiments teach us that sleep and convulsion are but one, mutually and readily interchangeable, the variation being determined by certain peculiarities resulting from mechanical or molecular variations of the nervous system; in a word, the one test gives us white light, the other a coloured spectrum.

He must be a dull observer of disease who has failed to recognise the close relationship of sleep and convulsion. How many an epileptic patient, for example, is distressed with the thought that, on laying himself down to rest for the night, sleep and convulsion will struggle for the possession of his nervous system, or that, on rising in the morning, and before he has

completely shaken off the influence of sleep, convulsion may assert its relationship!

After witnessing the extreme susceptibility of the mouse to the tetanizing action of thebaia and codeia, and seeing a powerful dog thrown over and over in the convulsions produced by cryptopia, nothing has surprised me more than to see the former little animal sleeping soundly for many hours under the influence of a moderate dose of cryptopia, and passing, under the action of a larger, from the state of narcotism to that of death, without the slightest movement.

What is the explanation of this apparent anomaly? Are the nervous systems of the different physiological classes of animals like different musical chords? and do the constituents of opium correspond to variations of a particular note, one of which is in unison with this particular chord, another with that, while all the rest are more or less at variance with both?

But, to return to facts, we have yet to discriminate a difference in the hypnotic action of cryptopia and morphia on the one hand, and a difference of excitant action between cryptopia and thebaia on the other. First as to the excitant action, the broad distinction between the two alkaloids is this—that the convulsion of thebaia is a *persistent* spasm, and that of cryptopia an *intermittent* one. Thebaia holds the muscles with the most inflexible rigor, and the stiffened and motionless body may be held straight out by one of the extended hind legs. Cryptopia throws the whole of the voluntary muscular system into rapid and violent vibration. Thebaia descends upon the muscles like a stroke of lightning; one minute the animal is tranquil in mind and body, the next he is thrown over, extended and stiffened, and, at the same time, suffocated by a prolonged iron-like grip of the chest. Cryptopia diffuses its influence gradually; at first there is but a restless vivacity of the ordinary movements, a mere impulse to greater muscular activity; after a while the impulse becomes stronger, but the animal is not yet deprived of control over his actions; and now follows a remarkable struggle between voluntary and involuntary movement. As the influence of cryptopia increases, the former slowly gives way to the latter; the battle, however, is severe, and the bodily and mental excitement intense, until the cryptopia obtains complete mastery, and then the helpless animal is thrown over on its side, vibrating with a violent,

intermittent spasm. The aëration of the blood, however, is not completely suspended, for the chest may still be said to pant under the influence of the spasm. The fit over, the animal is completely conquered and exhausted, and as the action of the alkaloid declines, and he slowly regains power over his movements, he now submits unresistingly to the influence of the cryptopia, and his body is affected with every variety of choreic movement. Thus, from first to last, cryptopia follows, so to speak, in the track of the ordinary movements, and ultimately excites them beyond the power of control; the primary chorea culminates in epilepsy, and the epileptic fits cease when the choreic movements deline in intensity.

Such is the main distinction between the convellent actions of thebaia and cryptopia on animals generally; but I must again go back to the mouse to show how this distinction is effaced. Thus, while cryptopia has no convellent action whatever on this animal, thebaia induces the vibratile spasm of cryptopia. Thebaia is to the mouse what cryptopia is to the dog, cat, or rabbit.

It now remains for us to consider the difference between the hypnotic and general effects of morphia and cryptopia. The sleep of cryptopia is as prolonged as that of morphia, but it is lighter and consequently more refreshing, and, as far as I have been able to ascertain, it is quite free from the illusions which so often attend sleep induced by morphia. But this is not the only advantage which cryptopia possesses over morphia. Cryptopia exercises no deranging influence over the vagus. The subcutaneous use of morphia in man is often followed by distressing sickness, and occasionally by alarming, not to say fatal, faintness; while in the dog, vomiting is the first and *invariable* consequence of its use. Such effects never, as far as I have seen, follow the use of cryptopia in any animal, whatever the dose may be. After the explanation given, and the want of similarity to the distressing effects of morphia, I cannot consider Obs. 8 as an exception to this statement. Cryptopia is therefore in many cases a pleasanter, and in all a safer, remedy than morphia given subcutaneously. As an anodyne I have reason to be well satisfied with cryptopia. I have employed it with a success equal to that obtainable by morphia, in several cases of severe neuralgia. Messrs. Smith prepare a soluble sulphate of the alkaloid, of which half a grain may be considered a medium

dose for a woman and one grain for a man, used subcutaneously. I prefer the acetate, however, as it is more soluble.

Thebaia.

I know of no observation on the action of this alkaloid on man. It is assumed to have a simple tetanizing effect. I discovered in my earlier experiments that this was an imperfect view of its action, and that like all the other active constituents of opium, thebaia induces the two apparently opposite states of hypnosis and tetanus. In the lower animals the tetanizing action so greatly exceeds and disturbs the hypnotic effect, that the latter is overlooked. But even in these animals a marked degree of somnolency may he observed under the influence of moderate doses of the alkaloid. In man, however, and in medicinal doses, hypnosis, with contraction of the pupil, is the only effect to be observed. In nearly all of the following observations I have sat by the side of the patient during the action of the drug with the view of catching the first indications of convulsive action, but I have uniformly failed to witness the slightest tendency thereto. The largest dose given by the subcutaneous tissue was one and a half grain = six grains by the alimentary canal. The thebaia employed is identical in chemical and physical characters with that used in my former observations (op. cit., p. 179). The solution used was formed by dissolving thebaia in water by the aid of acetic acid, ℿxv = one grain of the pure alkaloid. I have studied its action alone, and in combination with atropia, and in order to bring out its action upon man into stronger contrast, I shall preface my observations upon him by an illustration of the effects of a poisonous dose on the rabbit.

On the Rabbit.—*Obs.* 12.—Injected ℿxxx of the solution = gr. ii thebaia, by two punctures beneath the skin of a healthy full grown rabbit, B. At the seventh minute the animal was aroused from a state of quietude by a few preliminary convulsive starts, and then thrown upon the side in strong opisthotonous spasms, the head being strongly retracted, and the fore legs stretched forwards and shaken with a fine rigid spasm. This continued with momentary interruptions, when the chest was released, and the respirations (84 and regular) could be

counted for a few seconds, until the twelfth minute, when the hind legs were thrown out in rigid spasm, and semen was ejected. The spasm only relaxed with death, at the seventeenth minute. The chest was opened six minutes afterwards. The lungs were of a salmon colour, and completely collapsed above and behind the heart. The great veins at the roots of the lungs, the cavæ, and the right heart, were enormously distended with venous blood. The right ventricle was motionless, the right auricle pulsating faintly but regularly 72. The left heart was contracted and motionless. On relieving the distension of the right auricle by dividing some small branches of veins converging to it, the contractions of this cavity became stronger, and were increased to 200 a minute. On puncturing the inferior cava just above the liver, a minute later, a stream of black blood spouted forth, and the right ventricle at first became flaccid, then, having contracted, began to beat regularly 84 times a minute, the auricular contractions under the influence of the free depletion being at the same time reduced to 70. These contractions of the right heart continued until the eighteenth minute after the death of the animal (the thirty-fifth after the injection of the poison), the pericardium lying open the whole of the time. The urinary and gall bladders were full; the urine was thick from amorphous deposit, and of a primrose-yellow colour.

Death was the direct result of simple cramp of the muscles of respiration sufficiently prolonged to exhaust the arterial blood of its oxygen.

On Man.—*Obs.* 13.—Samuel M—, æt. 50. Pulse 84, pupils one eighth, respiration 19-20. Accustomed to the subcutaneous use of the active principles of opium, occasionally given for the relief of severe facial neuralgia (see "Old Veg. Neur," Obs. 60). ℿv of the solution = one third grain of thebaia were injected into the subcutaneous tissue of the arm. After fifteen minutes, somnolency. After thirty minutes continued somnolency; pulse 78, unchanged in volume and power; pupils one ninth; respiration 20-21, regular. After one hour, continued somnolency; pulse 78, a little fuller; pupils one ninth; respiration 20. After two and a half hours, somnolency had continued, and he had slept a quarter of an hour; but the effect was now passing off.

Pulse 78, decidedly fuller and stronger, and quite regular; pupils dilated to their initial size; mouth a little clammy; felt quite comfortable during the action and continued to do so. Now walked home and went to bed, and slept soundly all night.

Obs. 14.—After an interval of four months, pulse 76; pupils one ninth, at a given distance from a gas light; respiration 20. Injected ♏x of the solution = two thirds of a grain. After thirty-five minutes, considerable somnolency, "very heavy for sleep;" pulse 76, decidedly fuller; pupils one tenth. After one hour and ten minutes, continued somnolency; pulse 76, of increased volume and power; pupils one tenth. After two hours, somnolency passed of; pulse 68 of initial volume and power. Pupils nearly attained their initial dimension; respiration 20. Now walked home, went to bed, slept soundly all night, and experienced decided somnolency next day.

Obs. 15.—After an interval of a week, the pulse being 72, small and weak, with an occasional intermission, right pupil one ninth, left one sixth,[1] injected ♏xv = one grain. After thirty minutes, pulse 72, unchanged; pupils one tenth; respiration 20, regular; great somnolency, After one hour, pulse 78 without intermission; both pupils one tenth; respiration 21. Had slept quarter of an hour, and was still very sleepy. After two hours, pulse 72, regular; pupils returned to initial size; respiration 18-19. Had been sleeping most of the time comfortably.

Obs. 16.—After an interval of six months, injected ♏xix of the solution = one and a quarter grain, and he immediately walked home a distance of two miles, and went to bed. Somnolency came on ten minutes after the injection, and, after reaching home, he slept soundly through the remaining ten hours of the day, and the following night.

Obs. 17.—After an interval of five days, the pulse being 84 and small, the pupils one sixth, and the respiration 20, injected ♏xxiiss = one and a half grain of thebaia. After twenty minutes, pulse 76, unchanged in volume and power; pupils one eighth; respiration 21-22; great somnolency. After one hour and twenty minutes, pulse 76, unchanged; pupils one eighth; respiration

[1] The intermission of one or two beats a minute, and the inequality of the pupils, were symptoms which commonly attended a paroxysm of neuralgia. This was confined to the right side of the face, and caused slobbering from the angle of the mouth, and hyperæsthesia of the affected part.

19-20. Somnolency continued, but a paroxysm of tic prevented sleep. Went home, slept soundly until next morning.

Obs. 18.—Mrs. T—, æt. 38, a weakly woman with impaired innervation of the lower extremities. Pulse 80; pupils one eighth; injected ♏x of the solution = two thirds of a grain thebaia into the subcutaneous tissue of the arm. After five minutes, began to feel a little giddy and stupid. After forty minutes, continued to feel stupid and a little sickish and faint, and could not walk without the support of the wall or furniture, having great difficulty in getting the weaker leg from the ground. Pulse and pupils unchanged. After one hour pulse, 78 and fuller; pupils not appreciably smaller. The effects were now passing off, and she was sitting in a chair talking to a friend. Shortly after she lay down and dozed comfortably for the rest of the afternoon.

Obs. 19.—Frederick T—, æt. 22, rather lame from sciatica of eleven weeks' duration. Injected, on four separate occasions, $\frac{2}{3}$, 1, $1\frac{1}{3}$, and $1\frac{1}{2}$ grains of thebaia into the subcutaneous tissue of the thigh. A pleasant hypnotic effect followed each dose within ten minutes, increasing in intensity for the next hour, and then, as an irresistible influence, passing off; but, left quiet, the patient slept tranquilly for several hours afterwards. During sleep, or at the moment of awaking, the pupils were dilated, but on looking intently at a distant object they were decidedly contracted. The anodyne effect was such that the pain was relieved by the first injection, removed by the second, and has not returned since.

Obs. 20.—George H—, æt 20, a delicate youth, took two grains of thebaia by the mouth every third day, six times. It caused a slight and transient giddiness, coming on after half an hour, and lasting about thirty minutes. After one dose there was a little somnolency, but this was attributed to over-eating.

Conclusions.—I have finished my previous observations on the action of the active principles of opium with these words:—"Since cryptopia throws one animal into convulsions, and acts as a pure hypnotic to another, it is not unreasonable to suppose that there may be nervous systems which are able, in like manner, to convert a large portion, if not all, of the impressions excited by thebaia into soporific effects."[1] The foregoing observations on man realize this supposition, and form a proper sup-

[1] Op. cit., p. 192.

plement to what I have said respecting the connection between sleep and convulsion. The hypnotic action of thebaia on man is, as far as I have observed, free from all unpleasant effects (the symptoms mentioned in Obs. 18 would not have been experienced had the patient been recumbent and at rest). As a soporific 1½ grain is about equal to ¼ of a grain of a salt of morphia.

The contracting effect on the pupil is, in most cases, much weaker than that of morphia; but it possesses an equally stimulating effect upon the pulse. The influence upon the respiratory movemen's, however, is the reverse of that of morphia, viz. stimulant. During the action of a quarter or half grain of acetate of morphia, the respirations in Samuel M—, usually decreased to 16 or 15 a minute.

Thebaia and Atropia Combined.

The following observations were made upon Samuel M—, the subject of Obs. 13 to 17. The solution of thebaia was that used in the previous Observations. The solution of atropia contained two grains of the sulphate in one ounce of water.

Obs. 21.—Pulse 72; pupils one eighth. Injected one sixth of a grain of thebaia and one forty-eighth of a grain of atropia sulphate by one puncture. Somnolency came on within four minutes. After one hour, pulse 102, fuller; pupils unchanged. Conjunctiva slightly injected; mouth and throat dry; continued very sleepy and comfortable. After two hours, had dozed since last date; mouth still dry; pulse 100; of good volume and power; pupils one seventh and one sixth, right and left respectively. The effect was now passing off.

Obs. 22.—Pulse 72; pupils one eighth. Injected one fourth of a grain of thebaia and one forty-eighth of a grain of atropia sulphate by one puncture. After twenty minutes, pulse 100, slight somnolency, and a little dryness of the mouth. After one hour, continued very dozy and comfortable. Pulse 100; pupils unchanged; mouth and throat very dry; respiration 20, regular. After two hours and twenty minutes, pulse 88, contracted, regular; respiration 20, regular; right pupil one seventh, the left a trifle larger. Throat and mouth very dry; was still sleepy, but the effect was now passing off.

Obs. 23.—Pulse 74; pupils one eighth; respiration 20. Injected one third of a grain of thebaia and one forty-eighth of a grain of atropia sulphate by one puncture. After twenty minutes, pulse 120, of good volume and power; pupils unchanged; respiration 23; dryness of throat, and somnolency. After one hour, pulse 120, contracted, but of fair power; pupils still unchanged; respiration 20, regular; had been dozing. After two hours, had continued very sleepy; pulse 110, contracted and regular; pupils one seventh and one sixth; respiration 20. Went home and slept comfortably all night, and experienced somnolency the next day.

Obs. 24.—Pulse 72; pupils one eighth; respiration 21. Injected half a grain of thebaia and one fortieth of a grain of atropia sulphate by one puncture. After fifty minutes, pulse 120; pupils unchanged; throat and mouth quite dry; great somnolency since five minutes after the injection. After two hours, pulse 98, soft, and of good volume; pupils one seventh and one sixth; respiration 19; mouth still dry; had slept comfortably for some time.

Obs. 25.—Pulse 80; pupils one eighth and one seventh respectively. Injected one grain of thebaia and one forty-eighth of a grain of atropia sulphate by one puncture. After one hour, pulse 120; pupils unchanged; mouth and throat very dry; great somnolency, and had slept for quarter of an hour. After two hours pulse 98; pupils one seventh and one sixth; continued somnolency, but the effect was now passing off. Went home and slept soundly all night.

From a comparison of these observations with those on thebaia alone, it will appear that atropia increases and prolongs the hypnotic action of thebaia. I have previously shown that it does not diminish its convellent action (op. cit., p. 298). The counteracting effect of atropia upon the pupils, under the influence of thebaia and morphia, is about equal for equivalent doses. The stimulant effect of thebaia npon the respiratory movements is preserved under the combined action.

SOLANUM DULCAMARA

AS A MEDICINAL PLANT.

By JOHN HARLEY, M.D., &c.

The following is a contribution to the elucidation of a plant which still retains a place in the Pharmacopœias of Great Britain, of France, of Germany, and of the United States.

On the 26th August, 1867, Mr. Buckle, of Gray's Inn Road, expressed for me the juice of thirty-four pounds of fine plants grown in the northern outskirts of London.

The plants were laden with green fruit, and were destitute of roots. The quantity of juice obtained was seventeen imperial pints, weighing twenty-one pounds four ounces = 62·5 per cent. by weight, or 50 by measure. Part of this juice was converted into "*Succus*" in the manner and proportions directed in the Pharmacopœia for Succus Conii—but the precipitated matters were not separated;—and part into "*Extract.*" Ten pounds of the crude juice yielded fifteen ounces of extract. The evaporation was effected by steam heat, and the temperature was not allowed to rise above 170° Fahr.

On the 21st of September, 1869, I picked from sturdy trailing plants,[1] which grow in the full exposure to the sun on the shingly beach between West Worthing and Goring, in Sussex, forty-two ounces avoidupois of fine, ripe, mucilaginous, thin-skinned berries. They were pulped the same day and mixed in a stoppered bottle with proof spirit acidulated with 2½

[1] Var. γ *marinum*, Babington.

per cent. of dilute (10 per cent.) sulphuric acid, and allowed to macerate for several months at the ordinary temperature of the air. After percolation and exhaustion of the marc, fifty-four fluid ounces of a bright rose-red "*Tincture*" were obtained.

The addition of a trace of sulphuric acid was intended to facilitate the extraction of the dulcamarine. This tincture was of a bitter-sweet, nauseous taste.

1. The Juice.—One fluid ounce of this represented one and a half ounce of the herb.

Obs. 1.—Mary P—, æt. 50, a tall, well-developed woman, the subject of eczema of the face and paralysis agitans of three years' duration.

Half a grain of conia taken by the mouth was followed by coneism with inability to walk for about an hour. She took two fluid ounces of the Succus Dulcamaræ, sometimes filtered and sometimes not, on several occasions. Once or twice the unfiltered juice produced a little nausea, but no other effect.

Obs. 2.—J. J. H—, æt. 19, a nervous youth, subject to flatulency and colic from weak digestion. He took the unfiltered succus in doses increased from half to two fluid ounces every other day for a month. For the next week he took two fluid ounces of the juice, once a day, twice a day, and thrice a day at 11 a.m., 4 p.m., and 9 p.m.

After each increase of the dose, and at the end of the day after the six fluid ounces were taken, I carefully examined this patient, but could discover no effects induced by the medicine. At first the patient was a little disgusted with the dark brownish-green, thick, nauseous draught, but he became accustomed to it after the first few doses, and there were absolutely no effects, either objective or subjective, beyond a feeling as if he had taken an additional glass of beer, and due simply to alcohol. For example, on the 30th of September, 1867, he took two fluid ounces of the juice at 11 a.m., and again at 4 p.m. In the evening he came up to my house, and after sitting for half an hour the pulse was 84, of good volume and power. Pupils at a measured distance from a given source of light, $\frac{1}{6}''$; directed sideways, nearly $\frac{1}{4}''$ (these were the normal measurements). The tongue and palate clean and moist. He had not felt any effects from

his previous doses and had eaten heartily. At 8.40 p.m I gave him two fluid ounces more of the juice, and kept him sitting quietly under my observation for two hours. Although the conditions were favorable, neither somnolency, giddiness, feeling of dryness, nausea, nor, indeed, any other effect was appreciable. The pulse remained (under the stimulus of the alcohol, doubtless) at 84. The mouth and tongue were clean and wet, and the pupils unchanged.

Five fluid drachms of Succus conii produced moderate coneism of short duration in this patient. Thirty minims of Succus belladonnæ caused full atropism; the pulse attaining a maximum acceleration of 44 beats (numbering 120); the nostrils, posterior part of the tongue, the roof of the mouth, the soft palate and back of the pharynx being completely dry and glazed; the pupils dilated to $\frac{1}{4}''$—symptoms which were sustained at their height for more than an hour and then gradually declined. The action was accompanied by a little giddiness and more marked somnolency.

II. The Extract.—Thirty-three grains = one fluid ounce of crude juice.

Obs. 3.—Alfred L—, æt. 21, troubled with nervous spasm of the gullet; moderately strong, and like the former patient very susceptible of the action both of hemlock and belladonna.

He took the extract in doses increased from twenty to forty grains thrice a day, for sixteen consecutive days. I closely watched for symptoms as in the previous cases, but failed to observe any deviation from the normal condition. The patient himself, who was accustomed to observe and who would accurately describe the action of other drugs, experienced no effects.

Obs. 4.—J. W. W—, æt. 22, a weakly young man, took the extract in the same doses for six days consecutively, with the same absence of result.

III. Tincture of the ripe Fruit.—One fluid ounce represents 340 grains of the fruit.

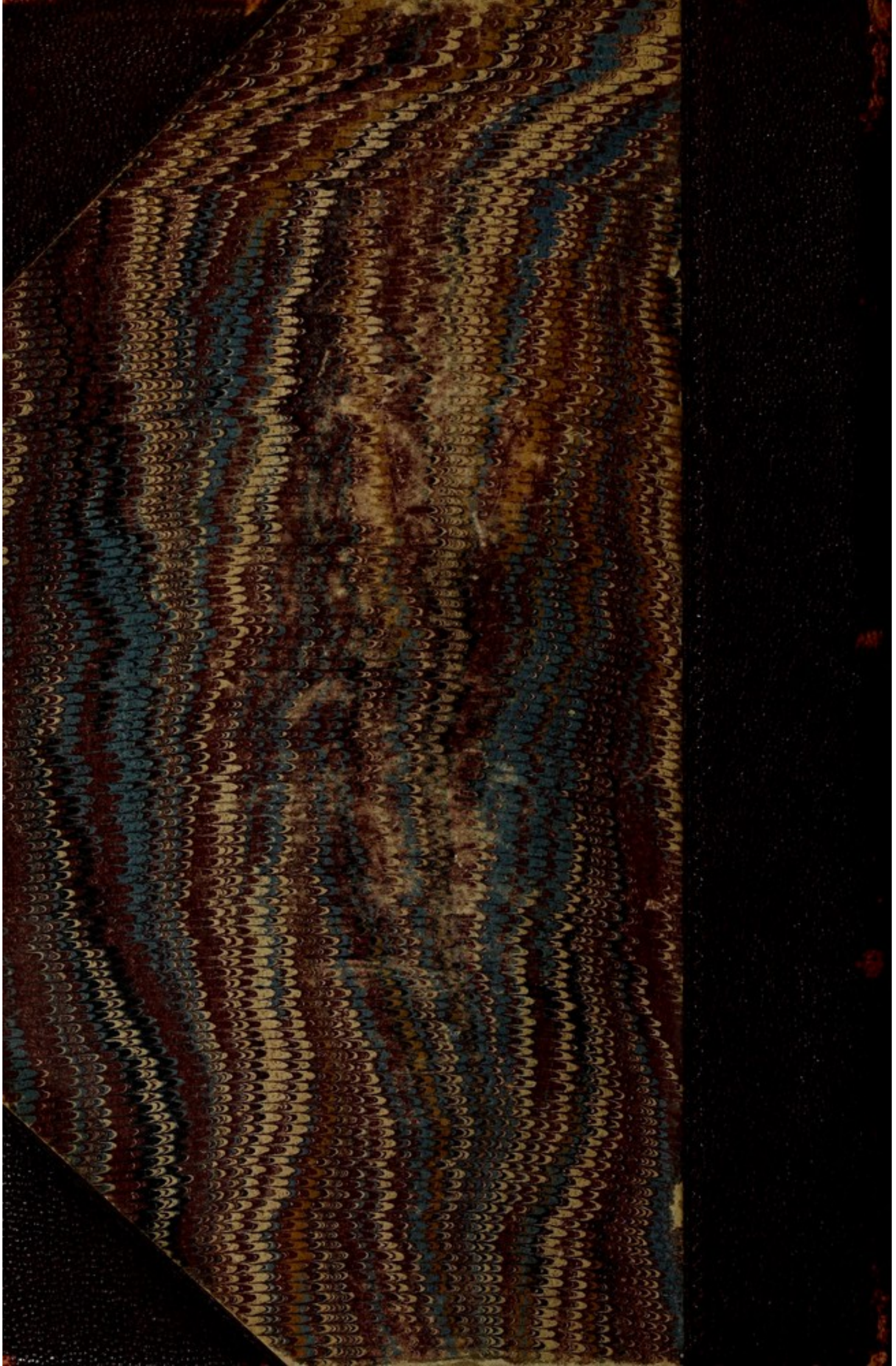
Obs. 5.—Samuel H—, æt. 9, a fair, well-developed child, the subject of epilepsy. He took the tincture in doses increased from two to twelve fluid drachms, every other day for

a month, without the production of any appreciable effects, immediate or subsequent.

Obs. 6.—Frederick G—, æt. 12, also the subject of epilepsy, took the tincture in doses increased from one to six fluid drachms, also without any effect.

Obs. 7.—Mary P—, æt. 50 (see *Obs.* 1), took the tincture in doses increased from four fluid drachms to two fluid ounces. The larger doses produced a little giddiness like that which she felt after a glass of gin and water, but beyond this effect the results were entirely negative.

Conclusions.—From the foregoing it appears—1. That a quantity of the juice equal to six and even nine ounces of the fresh herb may be taken daily, and for many days in succession, without appreciable effect. 2. That a quantity of the tincture equal to more than one and a half ounce of the ripe fruit, including the seeds, may be taken for a considerable time, also without appreciable effect. 3. From whence it follows that a decoction or infusion of the dried young branches of the plant (the part directed to be employed in the Pharmacopœias) is equally destitute of any active principle soluble in water, for if there were such it would be contained in the expressed juice.

These results are in accordance with those of Dunal and Fages,[1] of Frank[2] and Garrod.[3]

[1] Hist. nat. méd. et econom. des Solan., p. 71 et seq.
[2] Handb. d. Toxicologie, S. 61. 1803.
[3] Essent. Mat. Med., 4th Edition, p. 318.