proposal. I expressed my own opinion very clearly on the contagium of cholera as far back as 1867, holding that we had then no proof of the existence of a specific form of bacteria in cholera, but that the disease depended on the introduction of specific organic matter into the intestinal canal. The Egyptian cholera, however, of 1883 will certainly be connected in the minds of scientific men with the admirable researches commenced by Dr. Koch into the micro-organisms of cholera. This work Dr. Koch has subsequently carried on in Calcutta; and, although no one can receive his admirable reports with greater satisfaction than I do, it is impossible to ignore the fact that this most important work is being effected in our Indian possessions, it is true, by brethren, but nevertheless by rivals. Dr. Koch has found bacteria in the walls, epithelium, and glands of the intestinal canals of persons dying from cholera. He has separated and cultivated these bacteria, and finds they differ from those discovered in cases of diarrhoea and dysentery. The presence of these bacteria, Dr. Koch believes, excites sufficient irritation in the mucous membrane of the intestines to cause the symptoms of cholera. But it is said that heaps of micro-organisms exist in the contents of the intestinal canal and in decaying epithelium in all parts of the body; but this is no reason why some form of specific bacteria may not exist in cases of cholera. We might as well say that no form of pus contains specific qualities because, under the microscope, all pus looks very much alike. By its effects we know that pus differs in its properties in a very remarkable way. Then, again, it is said the micro-organisms are the effect of disease, not the cause. But how can disease produce a living micro-organism? If, on the other hand, you find the mucous membrane of the intestine perforated, and, in fact, its tissues swarming with micro-organisms, which appear to be living at the expense of these structures, surely it is not difficult to imagine that we have in such organisms a sufficient cause of irritation to account for the symptoms of cholera. It is satisfactory, however, to find that, while prosecuting his researches into the micro-organisms found in the walls of the intestines in cases of cholera, Dr. Koch has been led to inquire into the cause of the remarkable diminution in the death-rate from cholera in Calcutta since the introduction of the new water-supply into that city. In my work on the *History of Cholera*, published in 1876, p. 423, I have gone fully into this subject, and the still more remarkable instance of the condition of our troops in Fort William.

In conclusion, I hold with the views entertained by the majority of men who have most thoroughly studied the subject, that it is in the power of England to do very much towards preventing the extension of cholera from India over the world by means of well advised quarantine-regulations applied to vessels arriving from infected ports. I also believe that more might have been effected by our Government in India to lessen the death-rate among our European troops and the natives of that country from cholera; but that, when cholera exists in an epidemic or any other form in a country, there is one, and only one, way of averting its fatal effects, and that is by preventing the water and food which people consume from being contaminated by the organic matter passed by patients suffering from the disease. This infecting matter may retain its deadly influences if kept in a dried condition (as on soiled clothes) for years; but, if it pass into water containing elements which are probably essential to its development, it bursts forth into rapid growth. The life of this organic matter (if very possibly is a micro-organism) is, fortunately, of short duration; so that, if it pass into a river or well containing elements favourable to its growth, it springs into active life, but dies in a few days. Unless such a source of water-supply be again contaminated, it may be consumed with impunity in the course of a few days. The rapidity with which the organic matter passes through its stages of development depends largely upon the conditions of the atmosphere and the amount of sunlight it receives. If the organic infecting matter of cholera pass into water which does not contain elements essential to its development, it may remain sterile. My firm conviction is, that no amount of cleanliness, drainage, or any other means, will preserve a community from epidemic cholera if the food or water people consume be contaminated by the dejecta of cholera-patients. On the other hand, no amount of filth, overcrowding, or other unsanitary conditions, can produce epidemic cholera, if the organic infecting matter be kept out of the food and water. Unsanitary conditions predispose people to cholera. The majority of the world's populations, however, especially the lower class, live in such conditions; and therefore a greater number of the poor die from epidemic cholera than those who are in better circumstances.

SURGEON-MAJOR W. TEMPLE, M.B., V.C., Army Medical Department, has been appointed Secretary to the Surgeon-General Her Majesty's Forces, Bengal, in succession to Brigade-Surgeon R. Wolseley, M.D., who has vacated the appointment on promotion.

NOTES OF THREE CASES OF ARSENICAL POISONING.

By WILLIAM WHITFORD, M.D.,

Honorary Assistant-Surgeon to the Liverpool Cancer and Skin Hospital and to the Stanley Hospital.

IN my capacity of district medical officer to the parish of Liverpool, I was called to see Thomas Higgins, aged 45, on September 25th, 1883, as a probable case of fever. On examining him, I found his temperature and pulse normal. He stated to me that he had diarrhoea and felt "sickish," and that he had been drinking for a couple of days. He strongly smelt of drink. I ordered him a full dose of castor-oil, to be followed by a mixture consisting of opium and liquor bismuthi. I saw him again on the 29th, and found him weaker, and his temperature subnormal. I observed no evidence of drink on this second visit. In the interval between the visits, he had taken miscellaneous food, and there was doubt as to his having taken the mixture, at least regularly. There was tenderness on pressure over the lower abdominal region. The patient complained of vomiting, and "bad" diarrhoea. On October 2nd, three days after my last visit, his wife informed me that he had just died, and requested a certificate. I was surprised to hear of his death, for I had looked on his ailment as a comparatively trivial one. I closely questioned her as to his symptoms before death. She stated that he had frequent "bloody stools," and that he died suddenly. I gave a certificate assigning dysentery as the cause of death, although I had no definite opinion as to the exciting cause of the dysentery. On the evening of October 3rd, Patrick Higgins called on me, and stated that his brother, Thomas Higgins, had been heavily insured by his widow and her sister, Catherine Flannagan. On hearing this, my suspicions were first aroused, and I directed the brother to see the coroner, and to insist on an investigation being held. I called the following morning, and told the coroner that I had now grave suspicions of foul play. The coroner declined to order an inquest, but gave me verbal permission to make a *post mortem* examination, to verify or otherwise my suspicions, and directed his beadle to accompany me. After examining the body, as described below, with the assistance of Dr. Limrick, I gave directions for the funeral to be stopped, and placed a constable in charge of the room. I may here mention some symptoms and circumstances immediately preceding death which were sworn to during the recent trial. The deceased spoke of figures on the wall and around his bed, and yet, a few minutes before he died, he refused a drink offered by Mrs. Flannagan, and subsequently took some water offered by a stranger. He sat erect in bed whilst he drank it, and, having said "God bless you" to her, he lay down and died. The vomiting, purging, and consequent thirst were marked symptoms for the last two days.

The *post mortem* examination was made on October 4th, fifty-eight hours after death. Rigor mortis had disappeared, and slight discoloration was noticeable, but no stains in the depending portions. The conjunctivae were free from any yellowish tinge. On opening the abdomen, the following appearances were observed. The peritoneum, over its entire surface, presented its normal glistening character. On the anterior wall of the stomach, extending from the lesser curvature, and nearer to the cardiac than to the pyloric opening, a reddish patch, about four square inches in area, was seen through the semitransparent walls of the stomach. The duodenum was intensely inflamed, and it was separated with difficulty from the pancreas and other adjacent structures. The intestines, which were remarkably free from gaseous or other contents, had similar patches to the one described on the stomach. There were six on the small, and two on the large intestine, and these were scattered at irregular intervals over the tube. A most remarkable "cord-like" condition of the intestines was observed in parts for about two inches in length. There were three such cord-like contracted portions in the small bowel, and two in the large, and they presented no constant relation to the patches described. The mesenteric vessels presented an injected appearance in several places; but there was no visible continuity with these vessels and the inflamed patches of bowel. Except as described, the bowels were paler than normal. The stomach, after being tied at each end, was removed unopened, and placed in a clean jar. The intestines were similarly treated. The portal vein and its tributaries were empty, and the viscera generally were more bloodless than normal. The liver had a darkish appearance, but was otherwise normal. The gall-bladder was empty, and there was no biliary or other staining matter in the adjacent viscera. The spleen was enlarged and cirrhotic. The kidneys were deeply congested, presenting a dark colour throughout the entire section; the pyramids were unusually prominent. The bladder was empty, and presented no abnormal appearance. The lungs were pale, and there was no hypostatic congestion in the depending portions.

The heart was firmly contracted, and contained no blood in its several cavities. The left ventricle had a darkish appearance on its inner surface, very pronounced in parts. The main vessels were free from clots or other contents. The pleure and pericardium were normal. The brain and its membranes presented in a marked degree the bloodless condition which characterised the various organs of the body, with the exception of the kidneys and the endocardium of the left ventricle. The veins and sinuses were almost empty. No other abnormal appearance presented itself in the cranial contents. A portion of the liver, the spleen, one kidney, and the heart were removed from the body, placed in a jar, and sealed.

On October 6th, I made a detailed examination of the stomach and bowels, and their respective contents, in the laboratory of Mr. Davies, and in his presence. On opening the stomach, we found about two ounces of fluid contents, having no distinctive smell or colour. The inflammatory patch already noticed was confined to the mucous membrane. There were no adhering solid particles on its surface, or in its vicinity. The inflammatory condition of the duodenum rendered it easily torn, but the peritoneum covering it in part was unaffected. The small amount of semifluid matter in the intestines presented nothing unusual. The dark mahogany-like patches were about the size of a florin; and, as in the stomach, the staining was confined to the mucous membrane. The rectum was empty, and the vessels supplying its mucous surface were injected. Through the "cord-like" portions of the bowel a probe was passed, and the lumen of the tube was thus shown to be not entirely obliterated. These cord-like portions were paler than the adjacent bowel; and, as I have already stated, there was no apparent relation between these and the inflammatory patches. We examined microscopically one of the patches, with a low power, for crystals of arsenious acid. I had formed a strong opinion, from the symptoms and the pathological appearances, that arsenic had been the poison administered; and, in consequence, I requested Mr. Davies to first determine if it were present in any of the viscera. He found arsenic in all the abdominal viscera by Reinsch's test. Quantitatively, he determined that in twenty ounces of abdominal viscera there was one-third of a grain of arsenious acid.

Mr. F. W. Lowndes (surgeon to the Liverpool police) and I were jointly commissioned by the authorities to conduct an examination on two exhumed bodies at Ford Cemetery on January 16th, 1884. On our arrival at the cemetery, we were shown a grave in the public portion, from which a coffin had just been raised. The grave was formed of sand and clay, was about five feet deep, and the coffin of pine-deal was intact. The coffin-plate had on it the inscription, "Mary Higgins, died November 29th, 1882, aged 10 years." The coffin was removed to the mortuary of the cemetery, and the body identified in our presence. The grave-clothes were entire, though soiled. The eyes and part of the nose were destroyed by decomposition. The face and the body generally were slightly discoloured. The teeth were in their sockets, and the nails adhered to the fingers and toes. The integuments covering the chest and abdomen were intact. The body was that of a female under the age of puberty. On opening the chest, we found pleuritic adhesions on both sides, and a large quantity of blood-stained fluid in each pleural cavity. The heart and the pericardium presented no appearance of disease, and their respective structures were well preserved. On opening the abdomen, we found over the greater portion of the large and lower portion of the small bowel a bright yellow staining. The mesenteric vessels were similarly stained, and the mesenteric glands were greatly enlarged. The stomach had a pale grey appearance; and on its anterior wall, near to the lesser curvature, two small darkish patches were observed. It was secured with ligatures, removed unopened, and placed in a jar labelled A. The spleen was much diminished in size; the liver and kidneys were shrunken, and all three were paler than normal on section. They were placed in jar B. The intestines, having been ligatured, were removed, and placed in jar C. The other pelvic viscera were normal. We next examined the grave of John Flannagan. It was formed of dry sand and clay, and the coffin was about ten feet below the surface. The coffin-plate bore the inscription, "John Flannagan, died December 8th, 1880, aged 24 years." The pine-deal coffin was intact. On removing the covering from the face of the corpse, the face and body generally were found in a remarkable state of preservation, and were easily identified. The grave-clothes were entire. On the surface of the coverings next to the body, there were black and yellow stains, which we removed, and preserved for chemical examination. We found only slight indications of putrefaction. The features were well preserved, with the exception of the cartilages of the nose. The integuments over the chest and abdomen were intact. We found the lungs and heart much shrunken, but otherwise they and their enveloping mem-

branes were healthy and well preserved. The lungs had a granular feel on section. The stomach was of a whitish-grey colour, and was removed into jar D. The spleen was a mere shred, weighing about a quarter of an ounce. The liver and kidneys were shrunken, but well preserved; in fact, the latter organs might have been used for an anatomical demonstration. The three organs were placed in jar E. The gall-bladder, as in the case of the child Higgins, was empty, and there was no discoloration in its vicinity. The intestines presented externally, throughout most of their length, a characteristic golden yellow appearance; they were ligatured, and placed in jar F. No other abnormal appearances were noticed. The vessels used were clean glass jars. Each was closed with a glass stopper covered with white skin-leather, and securely tied. We each of us affixed a private seal to the jars; and all were labelled with the respective names of the deceased bodies and date of exhumation. On the following day (Thursday, January 17th), we attended at Mr. Davies's laboratory; and, in conjunction with him and Dr. Campbell Brown, we made a more detailed examination of the viscera.

In jar A (stomach of Mary Higgins) we found a brownish substance adhering very closely to the mucous membrane of the stomach, containing several small hard granules. On the removal of the matter, several small reddish patches were noticed, chiefly on the anterior wall. In jar C (intestines of Mary Higgins), we examined the bowels throughout their entire length. The golden yellow appearance was more pronounced on the inner than on the outer aspect. Small reddish spots were distinctly visible scattered over the lower four-fifths of the bowel. The mesenteric vessels were deeply stained yellow, and the mesenteric glands were much enlarged. Small hard granules were found in the contents.

In jar D (stomach of John Flannagan), the walls of the stomach were much attenuated, but entire. Some dark coloured matter tenaciously adhered to its mucous surface. Two small reddish spots on the anterior wall were noticed.

In jar F (intestines of John Flannagan), the intestines presented over nearly their whole extent in a marked degree the golden yellow staining which we had previously observed from the outer aspect. Some small reddish spots were noticed scattered over the mucous membrane, especially at the rectal end. Some granules were found in the contents. The mesenteric vessels were deeply stained yellow and the mesenteric glands were slightly enlarged. The granular particles which we had found in the various viscera of both bodies were examined microscopically, acetic acid being added, and were shown to be of a phosphatic character; evidently the crystallised products of decomposition. Another problem presented itself for solution. Was the yellow pigmentary substance sulphide of arsenic, or was it of a biliary nature? Dr. Campbell Brown doubted its being an arsenical compound, from the amount present, and from its wide diffusion. He and Mr. Davies undertook to determine this point, and I may anticipate so far as to state that they have shown, not only by the amount of arsenic present in the respective bodies, but by direct chemical tests, that the yellow matter is not sulphide of arsenic. I may here mention that the abdominal viscera of Mary Higgins contained one grain of arsenious acid; and that of John Flannagan three grains and a quarter. In none of the cases were crystals of arsenious acid found, so we have assumed the poison had been administered in solution. In each of the exhumed bodies, certificates had been given, assigning the cause of death to bronchitis. It was given in evidence at the recent trial that, in each case, there had been at least a week's illness, and that vomiting and purging were symptoms.

REMARKS.—The case of Thomas Higgins presents many noteworthy features. There are many points of resemblance with the one reported (*Lancet*, February 25th, 1854, p. 224, "Atlee Family.") The bloodless condition of the body, the firmly contracted heart, the enlargement of the mesenteric glands, and the survival of the patient for seven or eight days after the first attack of vomiting and purging, which is most unusual, are common conditions. Further, in both cases it has been fairly shown that the poison had been administered in small doses, frequently repeated. On the other hand, the condition of the stomach and duodenum contrast strongly with their healthy state in the reported case. In the case reported by Dr. Wilks (*Lancet*, March 29th, 1862, p. 325), the person died twelve hours after taking half an ounce of arsenic. Dr. Wilks found an ecchymosed condition of the left ventricular endocardium, and a contracted condition of the colon, conditions which strikingly resemble those found in the case of Higgins. The remarkable "cord-like" contractions of not only the colon, but of the small intestine of Higgins, strongly indicate nervous irritation, and would seem to favour the theory of Esser that diarrhoea in general is due to irritation of the intestinal ganglia, and not to paralysis of the splanchnics. Was the firmly contracted condition of the heart due

to a similar cause? If so, can we call the mode of death syncope, or shall we attribute the contracted condition of the heart to the want of blood-supply? These are interesting questions, and I do not presume to offer an opinion. Dr. Campbell Brown gave as his opinion at the trial, that the man Higgins had been taking arsenic for several days before death. His reason was that he found six times as much arsenic in a given weight of spleen as in an equal weight of liver. This condition would indicate relatively large hepatic elimination, and this elimination would involve the element of time. I gave a similar opinion, and the pathological reason that I assigned was the uniform distribution of the inflammatory patches throughout the intestinal canal. On this point, see Dr. Harley's note (*Lancet*, November 23rd, 1861, p. 499). Messrs. Lowndes and Davies declined to give an opinion on the point with regard to any of the cases. I shall only make a few remarks regarding the exhumed bodies. The absence of any indication of kidney-congestion, or of marked inflammation of duodenum, contrasts strongly with the condition in the case of Higgins, and resembles the "Atlee Family" case. The nature of this yellow pigment is a matter of much interest, and the profession is indebted to Dr. Campbell Brown and Mr. Davies for the trouble they have taken. It appears strange that a biliary pigment should be absent from the duodenum and upper part of the jejunum, and present in the remaining portion of the bowel. Possibly the pigmentary matter is a product of the intestinal juices and the hepatic secretion; and, as we know the glandular structures vary in the different parts of the tube, we may account for the pigmentary distribution in the two bodies. Further, as arsenic is stored up in the hepatic cells and the intestinal glandular structures, we can readily understand an alteration in the character of their respective secretions, and thus account for the pigment being present in cases of arsenical poisoning. It evidently requires a considerable time to produce these chemical changes, for the pigment is not present until the body has been buried for a considerable period. Possibly an atmosphere developed by putrefactive changes may determine the combination which results in the formation of the yellow pigment.

ON THE YELLOW PIGMENT FOUND IN THE INTESTINES IN CASES OF ARSENICAL POISONING.

By J. CAMPBELL BROWN, D.Sc., AND
EDWARD DAVIES, F.C.S.

It has frequently been recorded that a yellow colour has been obtained in the stomach and intestines of persons who have died from arsenical poisoning, after long interment. It is not always stated to what this yellow colour is due; but it has sometimes been attributed to the formation of sulphide of arsenic. Thus, in Taylor on *Poisons*, the following passages occur. "White arsenic slowly becomes changed to yellow sulphide by the evolution of sulphuretted hydrogen in the decomposition of the stomach or of its contents. It then forms a deep yellow stain through the coats, and appears on the external surface." "In Mrs. Smith's case, the sulphide of arsenic was discovered in the stomach fourteen months after interment." "In the case of the Cheshams, the coats of the stomach were in both instances deeply dyed with large patches of yellow sulphide nineteen months after interment." "In some cases, the coats of the stomach and intestines, the liver, diaphragm, and even the bones of the spinal column, may be thus deeply stained of a yellow colour."

In *Reports of Trials for Murder by Poisoning*, by Lathom Browne, and Stewart, the following passage occurs. "In bodies long buried, the arsenic is often converted into sulphide by putrefaction, and then appears as a yellow coating."

No proof has ever been adduced, so far as we are aware, that the yellow substance is really sulphide of arsenic. We have recently had an opportunity of examining a yellow substance found in the circumstances referred to, in two bodies exhumed in January last, and think it desirable to place our observations on record.

One of the bodies was that of a young man, aged 22, which had lain in the grave upwards of three years. It was in a state of good preservation, the stomach, intestines, and viscera having decreased in size without losing their usual form and appearance. From the whole of the abdominal viscera, three and a quarter grains of arsenic were extracted. The whole of the small intestines were coated internally with a bright yellow pigment resembling mustard, as were also the greater part of the mesenteric vessels. The colour was visible through the walls of the intestines. It reminded one of orpiment, and in some places of realgar. It was not present near the gall-duct.

The other body was that of a girl, aged 10 years, which had been in the grave more than thirteen months. The viscera were in a good

state of preservation, although contracted. From the abdominal viscera one grain of arsenic was extracted. The bright yellow pigment was distinctly present in the intestines and mesentery, although the quantity was not so great as in the previous case.

In another body, which had not been buried, no yellow pigment was found, although there was more than a grain of arsenic in the viscera.

In a fourth body, which had been in the grave less than a year, but in which the quantity of arsenic was probably not more than half a grain, the yellow pigment was perceptible, but the quantity was very small.

We collected a considerable quantity of the yellow pigment, weighing in the moist state between twenty and thirty grains. It was carefully tested for arsenic, and was found to contain no appreciable quantity of arsenic. It certainly was not sulphide of arsenic. Nitric acid produced a play of indistinct colours similar to those produced in bile by nitric acid.

We found that the yellow pigment was readily soluble in chloroform, forming a bright and clear yellow solution; less soluble in alcohol; slightly soluble in strong ammonia, reprecipitated by hydrochloric acid; and insoluble in water. The chloroform-solution left on evaporation a deep yellow residue. This yellow residue was reddened by strong hydrochloric acid, while nascent hydrogen from zinc and hydrochloric acid discharged the colour and dissolved the residue. Nitric acid converted it into a purple, then red, then brown substance. Sulphuric acid gave a temporary violet colour, quickly becoming brown. Sulphuric acid and pure sugar gave the violet purple tint characteristic of Pettenkofer's test.

THE TREATMENT OF GONORRHOEA BY OPEN WIRE BOUGIES.

By D. C. M'VAIL, M.B.,

Lecturer on Medicine, Western Medical School, Glasgow.

GONORRHOEA is a specific catarrh of the mucous lining of the urethra—a condition in which there is rapid inflammatory cell-proliferation, and exudation of fluid from the mucous surface. These catarrhal changes necessarily begin at the anterior extremity of the urethra, and travel backwards. The fossa navicularis suffers early and severely, and backwards along the course of the passage, another part that is severely affected is the sinus of the bulb. These two parts are wider than the parts of the canal immediately behind each, and so small portions of fluid are apt to lodge more persistently there than in other parts of the canal.

In the local treatment of this affection, it is obviously very desirable to keep separate the inflamed mucous surfaces. The condition is in many respects analogous to a moist eczema intertrigo, where cure is indefinitely postponed unless the surfaces are, by suitable dressing, maintained apart. The injections in gonorrhoea that have been most successful are those that have best fulfilled this indication of treatment, and lately Mr. Cheyne's medicated bougies of cacao-butter have given further aid in this direction. To carry out more effectually the keeping separate the secreting surfaces, I have had made open wire bougies. These are of two forms.

The first form (Fig. 1) is for the effective administration of injection.

Fig. 1.

The part *a* is a short length of catheter-tube, to which are soldered the wires of the open bougie, part *b*, and to the part *a* is also attached a short piece of India-rubber tube *c*. This instrument being introduced until the part *a* is well within the meatus of the urethra, the solution to be injected is introduced by a syringe, and, when quite full, the India-rubber tube *c* is compressed by a spring clip, to prevent the escape of the fluid. Within from twenty to thirty minutes, the injection will be almost wholly absorbed by the urethral walls, and then the instrument may be withdrawn. By this means, the injection is applied to, and kept applied to, any part of the urethra that may require it until entirely absorbed. By the ordinary method at present in use, the contact is at best but very brief; and, as the part of the passage that is most in need of treatment is usually the most irritable, the injection is, by the instantaneous reflex contraction of that part, at once driven from it into other portions of the canal.

The second form (Fig. 2) is an open wire arrangement throughout, and is constantly worn by the patient, so that the discharge may drain