

disinfectant, and partly as a religious ceremony. The laws of quarantine are practically the same to-day as they were three thousand years ago, and the separation of the infected from those that are free, which seems to be dawning upon the authorities as desirable, but by no means essential, was very stringent, any failure upon the part of the infected being punishable with death.

We next find that the Italian tribes worshiped the pastoral goddess Pales, and were in the habit of calling down blessings for the fruitfulness and health of their flocks; but evidently at that date full reliance was not placed upon the blessings of the goddess, as they found it necessary or helpful for the health of their flocks to pass them through the fumes of sulphur. We also find that Ulysses was acquainted with the value of sulphur, as he used it for removing the smell arising from the dead bodies of the suitors for the hand of his wife after their massacre.

For many centuries little was done to prevent the spread of infectious diseases, the ravages of the plague decimating the world; and as the population increased the huddling together of the poorer classes always gave a foothold to any epidemic, as was so vividly witnessed by the plague in London, in 1665, when the deaths were over 100,000; and during the visitation of cholera to Europe in 1830 to 1834, the deaths in the Caucasus were 10,000 in a population of 16,000, and in one province of Russia the deaths were 31,000 in 54,000. In 1666, the year following the plague in London, came the great sanitary engineer, the fire, destroying the unhealthy and unsanitary rookeries where, during the previous year, the plague had held high festival. At the end of the eighteenth century some attention was paid to antiseptics: the list of those recommended, at any rate, gave sufficient for any one to choose from, but their value, in most instances, was very small, as the following list will show: alkalies and salts, gum resins, such as myrrh, assafetida, etc., decoctions of Virginian snake root, pepper, ginger, saffron, sage, mint, valerian, rhubarb, senna, wormwood, celery, turnips, carrots, garlic, onions, cabbage, horseradish, and molasses. More attention was also paid to drainage of houses and streets. Wooden pipes, of which a specimen in oak 6 feet 6 inches long, 7½ inches square, and 3½ inches bore is shown at the Health Exhibition, taken from Hackett's Hotel, Piccadilly, London, and supposed to have been laid down about one hundred years ago, brick drains, wood troughs, and common tiles being used, generally having an outlet into a cesspool for all the matter that had not previously percolated through the wooden troughs and joints of the tiles, the heavier portion settling to the bottom and the liquid running over. The cesspool, being placed generally in a place not lending itself to easy access, was only cleared out when the stench became unbearable or some serious outbreak of disease drew attention to it. Following this period we come down to the visitation of cholera to this country in 1832, when the public mind was specially directed to improvements in sanitary matters. It is only, therefore, within the last fifty years that the subject of sanitation has had much attention paid to it; but during that period much work has been done under the Public Health Act and the separate Acts of Parliament for most of our large boroughs and local board districts. The engineer has been called in, vast waterworks have been formed, and water at high pressure is now obtainable in all our large towns and most of our smaller ones; thousands of miles of sewers and drains have been made; thousands of miles of streets have been paved with sets, and the parapets flagged; thousands of old houses, veritable dens of disease, have been swept away; time-honored graveyards have been closed and cemeteries opened, originally placed at some distance from the centers of our dense populations, but which now, unfortunately, with the rapid growth of our towns, are surrounded as much as the old churchyards were. The question of the disposal of our dead is a matter that will have to be faced, and let us hope that public opinion may be guided to the rational system of cremation. The great demand for sanitary work has called into the field inventors by the hundred, with their patent sockets, glazed earthenware pipes in place of the old wooden trough, stench traps and ventilators for the streets, patent water-closets by the score, etc., etc., so that the engineer of the day has had nice material to work with, and with it he has doubtless made a good show in our houses and left substantial work in our streets. But still, with all this skill and all these improvements, and the many millions of pounds sterling that have been spent and still are being spent to carry them out, the undeniable fact still remains that the death-rate of the kingdom is fully one-third greater than it should be, and that the general sanitary arrangements are provocative of disease instead of being preventive. Sir Robert Rawlinson, C.B., states that in Dublin and its vicinity there is not a single residence in a satisfactory condition; and in the metropolis it is stated, on the experience of sanitarians, that there are not five hundred houses properly and safely drained. You may go further, and say that there are not five hundred in the kingdom, and also that, to a great extent, the millions spent on the vast sewerage schemes have been literally, not figuratively, thrown into the gutter, and thence into the sewer; that in all these great and small schemes, whatever the object has been, the effect is to make sewer gas and poison the people, and that the first principles of sanitation have been openly and willfully neglected—"the prevention of decomposition or fermentation."

What is the result of decomposition? Sewer gas and germ development. Sewer gas is formed of various bodies or component parts, as CO, CO₂, C₂H₄N, etc.; SO₂, SH₂. While the fermentation is going on, zymotic development is caused. That is, pre-existing germs becoming active organisms by fermentation taking place, as Pasteur demonstrates, by atmospheric influence, "not upon its oxygen or any gaseous constituents, but upon minute particles suspended in it, which are germs of various low forms of existence." Professor Tyndall calculates that germs equal to the population of the world could be placed on four square inches, and that one million could be piled on the head of a pin. Among the interesting facts pointed out by Dr. Duclaux, in his valuable work on fermentation, the rapidity of development of some of the lower forms of life stands out in prominent array. Speaking of the development of certain germs (bacteria) he says Cohn "found that it would take two hours for two living organisms proceeding from segmentation in certain bacteria to attain

the dimensions of the parent, and in their turn to multiply. Hence in three days the progeny of a single specimen if unhampered would number 4,772 billions. As it is about the thousandth of a millimeter in breadth and two in length, and as its density is about the same as that of water, 536 millions would be required to make the weight of a milligramme (about 0.015 of a grain English). It is then easy to calculate that the offspring of a single specimen would in twenty-four hours only weigh the fiftieth of a milligramme; but at the end of three days it would weigh 7,500 tons." Such figures show us, in truth, that we must cease to wonder at the rapid spread of diseases when these germs multiply and increase at such an alarming rate. We thus find that our tens of thousands of miles of sewers and drains are forcing-houses for germ development, the matter passing into the sewer. Commencing immediately to decompose, the sewers becoming one immense gas factory provided, as the law directs, with street ventilators which pour forth, both when we are asleep and when we wake, sewer gas laden with myriads of germs in a more or less active condition, ever ready and willing to attack the weak and ailing. The fatal results arising from this dissemination of sewer gas into our streets is indeed great, but can bear no comparison with the effects of sewer gas entering into our houses from water-closets, slopstones, etc. It is generally supposed that the water-traps attached to water-closets, etc., are a perfect seal against the back pressure of noxious vapors from the sewer; but we only have to think for one moment and the fallacy is apparent. The depth of water in ordinary traps is some six inches, and the atmospheric pressure being sufficient to balance a column of water of thirty-four feet, it is self-evident that an increase of pressure in the sewers of only three ounces per square inch would overcome the six inches of water in the trap, and that as at present arranged they are only a delusion and a snare. Mr. C. P. Cotton, Engineering Inspector of Sanitary Work in Ireland, in a valuable paper read at the Sanitary Congress at Dublin, states, "I have seen sewer gas pouring back through a sink into a house in one of the best parts of Dublin (indeed, my attention was attracted by the noise), owing to the filling of the low levels of the sewers by the tide." If further proof be needed that gas can overcome the water in the stench traps of houses, we have only to refer to the account of the correspondent of the *Daily News* in Naples, that in burning sulphur in the sewers to disinfect them the fumes entered the houses through the closets during the night, nearly suffocating the inmates, driving them out into the streets, where they aroused their neighbors and crying out that they were being poisoned intentionally.

Having proved that sewer gas is the result of decomposition, and that fermentation is the cause of germ development, and that the sewers are always fully charged with the death-dealing compound, and that the sewer and closet traps are inadequate to deal with the gas, the question comes, Is there any method or means by which decomposition can be hindered and sewers utilized, as originally intended, for the conveyance of sewage to a given point without the matter undergoing change? Many schemes have been devised.

The system of Mr. Shone is one that has many features to recommend it, being very superior to the present plan; it is in operation at Warrington and Eastbourne. The plan is to connect the house drains with the sewer, this sewer being connected at one end with a tank sunk to a depth to allow any desired fall in the sewer. When this tank is filled to a certain point, a float connected with the valve of an air compressor is opened and the sewage matter is ejected into a sealed pipe, and forced either into another tank at a higher elevation or direct, it may be, to a sewage farm several miles distant. The pressure of air employed is about 50 lb. to the square inch, and at an exhibition at Warrington to show the power, the sewage was ejected from a tank into the open air to the height of about 80 feet. The olfactory nerves were soon satisfied of its efficiency, and if further proof was wanted, the descent of the vile compound among the invited guests quickly decided the matter. The late Mr. Spence, of Manchester, whose personal friendship I had the honor of having for many years, suggested, many years ago, a system of atmospheric or gaseous sewerage, the idea being to connect the chimneys of the houses with the sewers, leading them to centralizing conduits converging to a point where an immense chimney, 600 feet high, would be erected to discharge the gases into the atmosphere, the ascensive power being obtained either from the retained heat of the gases, or if this was not sufficient, by the addition of artificial heat or a fan. Mr. Spence gave the figures for a chimney necessary for the purpose, proposing that the chimney should have an internal diameter at the top of 100 feet, and an external diameter at the bottom of 140 feet, and estimating its cost at about £40,000. The capacity of the chimney for conveying smoke gases, on the calculations of a velocity of 40 feet per second, would be in twelve hours 480,000 cubic yards. The gases from the combustion of two million tons of coal per annum represent 46,000,000 cubic yards per day. So that the calculations allow room for nine times as much gas from the sewers, which would be very ample.

Mr. Spence stated that the value of the sewage from Manchester and Salford, with the ammonia contained in the coal, would have a commercial value of £800,000 per annum; during this gaseous process the sewage would be thoroughly disinfected by the sulphurous acid gas contained in the smoke. The Corporation could easily try the plan at Kensington fields, and it would have been very advantageous in the erection in Nash Grove for purifying the sewer gas pouring out of the ventilators; by this means the sewage would be disinfected, and the manurial properties contained in the smoke deposited. This scheme would undoubtedly act very well, though the expense of remodeling our houses and sewers puts the adoption of it out of court for the present. But where new towns are being laid out, the adoption of the principle could easily be carried out, and as the central smoke stack would carry all deleterious vapors clear away, the houses could be made with flat roofs and laid out as flower gardens.

I could also propose the burning of fires in the streets over the ventilators; this would doubtless draw out all the bad gas, and the number of ventilators could be reduced, but this would interfere with the traffic, besides being an eyesore.

The placing of charcoal over the ventilators has an effect, but for a brief period only, as was proved at Southport during the visit of the British Association. The poor levels of the sewers there always cause a pressure of sewer gas when the tide is up, and walking down any part of the town the smell is anything but pleasant. The visit of such a learned body to Southport was an event of which capital could be made, and the Corporation, always zealous in forwarding the interest of the inhabitants, bethought them that if they could only get the sewer smells done away with during the meeting they would be enabled to get a testimonial as to the salubrity of the place and its freedom from noxious inhalations. Charcoal filters were applied for a few weeks, and the result was all that was required, but they were, I believe, done away with as soon as the object was attained.

With the exception of Mr. Spence's system, decomposition of sewage matter must and will take place, for even if Mr. Shone's system were generally adopted the sewage matter would require deodorizing prior to being placed upon the land. In nature's economy it was doubtless intended that refuse matter should return to the land to increase the productiveness, but so far, with only one or two exceptions, such as Aylesbury, Aldershot, etc., sewage farming has been a failure commercially. Not that the ratepayers would grumble at being taxed to cover the loss; but the enormous quantities to be treated, and the confession by those in authority that the money already spent on sewage schemes was of little value, will prevent for a long time the subject being grappled with. What we must look to in any case is the prevention of decomposition, and the application of antiseptics in our houses before the kitchen refuse and excreta from our water-closets pass into the sewers. By this means the enormous amount of sewage matter daily discharged into our rivers would be thoroughly disinfected, and no ill effects from sewer gas would be perceptible. In the case of the Thames, 160,000,000 gallons per day are discharged into it, and often in consequence of the lowness of the upland water there is from fourteen days' to thirty days' sewage washing backward and forward at the rise and fall of the tide, awaiting a freshet to carry it out to sea, in the mean time throwing off its vile gases continually.

If the Commissioners of Sewers were to see to the application of antiseptics prior to the matter passing into the sewers, the houses and streets of the metropolis would be pure, and the Thames, although often containing sewage matter in motion, would not throw off any objectionable or dangerous exhalation. When we know that at the outlet works on the Thames the Commissioners used during August 180 tons of chloride of lime per week, the effect being extremely beneficial as far as the river was concerned, although the matter had then undergone considerable decomposition, it is self-evident that if the antiseptic were applied before fermentation commenced a much less quantity would be necessary.

This being proved, the question will be, What are the most powerful antiseptics and disinfectors? The most effective and active are those which evaporate or throw off their essential gases, as chloride of lime and tar acid. The objection to chloride of lime is that it so quickly deteriorates and becomes worthless, and acts only, as Angus Smith says, "upon putrefaction that already exists," but tar acid acts upon the process, and prevents the tendency to putrefy. The action of the best known tar acid—carbolic—upon germ development has been so amply proved by the highest authorities that it is needless to discuss further upon its merits; but I would draw your attention to a rival preparation that undoubtedly will be much heard of in the future: it is made from a combination of tar acids, and has many points in its favor for which it will doubtless receive the preference.

THE PREPARATION OF COCAINE.

By A. CASTAING, Ph.G.

COCAINE is undoubtedly the great object of interest of the moment, and there is not a physician of progressive ideas who is not anxious to test the marvellous effects of the new anæsthetic. The drug trade, taken unawares by the sudden and sustained demand for cocaine of the various brands which are guarantees of genuineness, is unable to keep pace with it, and is therefore compelled to offer a substitute in many cases inferior to the article called for by the doctor's prescription. The natural consequence is that the anticipated effect is not produced, and the wished for and confidently expected local insensibility is not attained. The practitioner is disappointed at his first experiment, his professional pride receives a shock, and in his mind doubt takes the place of the enthusiasm he was at first inspired with. Yet it would be wrong to cast the blame upon cocaine, for the alkaloid, when real and chemically pure, does truly possess the power of producing local anæsthesia, not only on mucous membranes, but also on the whole surface of the epidermis, and, to a certain depth, beneath it.

Considering the difficulties attendant on obtaining the genuine article, we think we shall do well to make known a way, which repeated trials have shown us to be the most effectual, to extract the alkaloid from the *Erythroxylon Coca*. Having observed that cocaine is extremely susceptible of change under the influence of acids, we studied how to exhaust the coca leaves without using acidulated liquids, and discovered the following method, by which one grain of cocaine can be extracted from four hundred and eighty grains of leaves. To obtain this result, however, it is requisite that the coca leaves be of good quality—that is, gathered at the right time and place, properly dried (a leaf with brown spots on it, resulting from moisture, has lost all value)—and, above all, not injured by age or by exposure to the air and consequent evaporation.

MODUS OPERANDI.—On one part (by weight) of coca leaves pour eight parts of boiling water, and let them steep for half an hour in a closed vessel in a water bath. Pour the whole into a percolator, and, when all the liquid part is strained off, continue the exhaustion of the leaves by pouring on them eight parts of alcohol at 85°. Mix the two liquors and precipitate them by means of acetate of lead, draw off with a siphon, and then add sulphate of sodium to remove the salts of lead. Filter, and evaporate at a gentle heat until the liquid has attained the consistence of sirup. Treat the whole

with water to separate the resinous part, and then precipitate with carbonate of sodium. The precipitate is then to be exhausted by sulphuric ether, and the ethereal solution, after the ether is distilled, is exposed to the air until every trace of ether has completely disappeared. By this means is obtained a crystallized residue of a brownish yellow and of a disagreeable smell. This is impure cocaine.

The coloring matter is removed by washing once or twice with cold alcohol. The cocaine, thus purified, appears in the form of transparent prisms, without smell, bitter to the taste, soluble in seven hundred parts of cold water, more soluble in alcohol, and entirely soluble in ether. The solution has an alkaline reaction, and when applied to the tongue it imparts a bitter taste and a certain insensibility, followed by a slight sensation of cold, recalling the effect of ether spray upon the epidermis.

Heated to 208° F. the cocaine becomes liquid, and, under the influence of cold, it becomes a transparent mass, which gradually assumes a crystalline form. If it be exposed to a degree of heat higher than 208° F., cocaine changes its color, and decomposes. It is inflammable, and burns with a brilliant flame, leaving an ash behind it. It forms soluble salts with acids (its hydrochlorate is the best), and all these salts are more bitter than the alkaloid. It is a compound of carbon, hydrogen, nitrogen, and oxygen.

The medical profession is well acquainted with the effects of wines, extracts, and infusions of coca. I trust that what I have written above will show clearly how its action varies in accordance with the amount of cocaine contained by the leaves, and that in order to

temple, excavations were made on a lower level, and the result of three months' excavation was that an oblong building, surrounded by arcades, or colonnades, was exhumed. Its dimensions were 113 ft. by 41 ft. In and around it several singular pieces of sculpture were dug up.

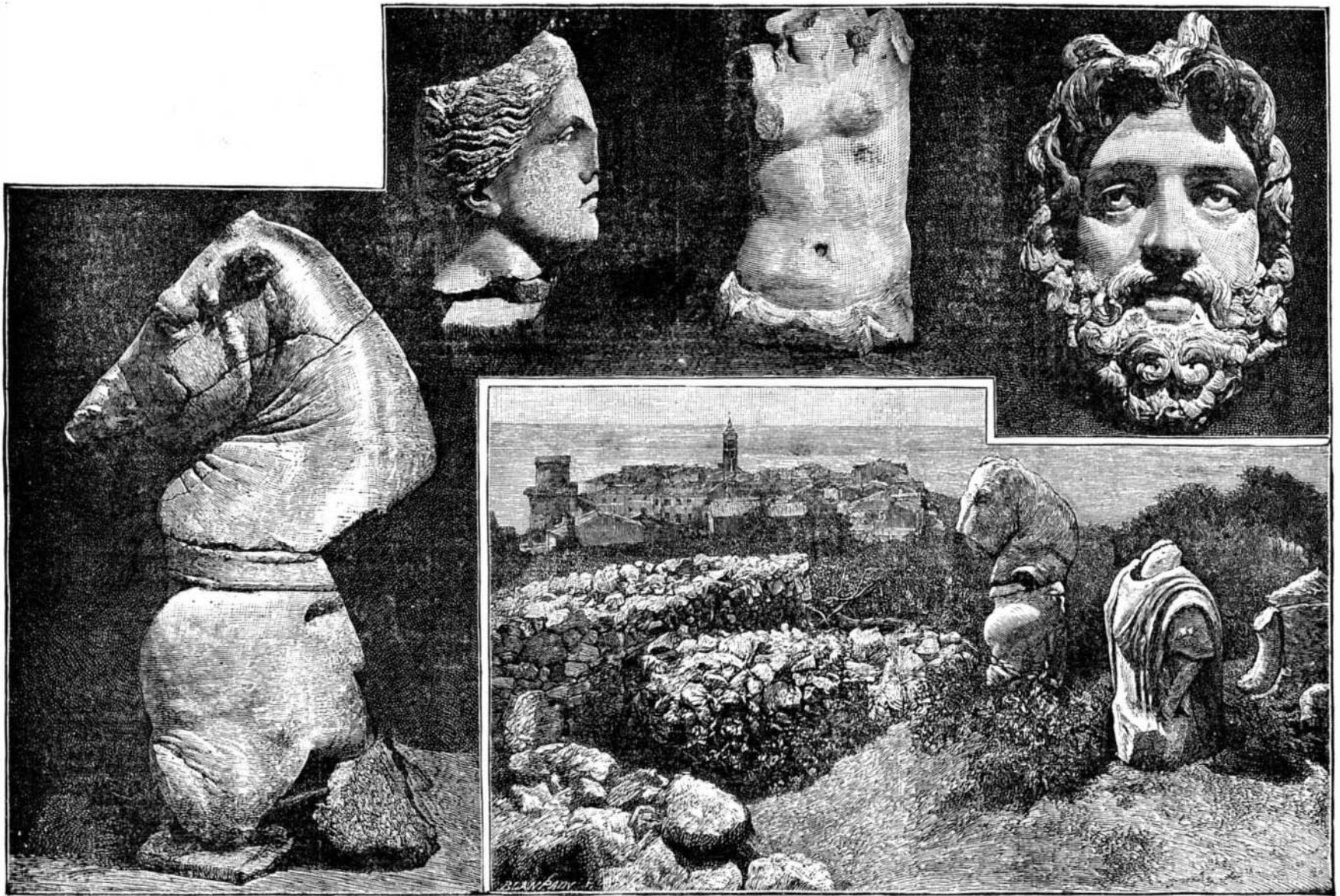
Three horses' heads in Parian marble, life-size, were found. Mr. Pullan considers these to be either original Greek work or the imitation of Greek work by Roman sculptors before the time of the Christian era. From the fact that subsequently the ear of a fourth horse and also the spoke of a chariot-wheel were discovered, he thinks that these were the horses of a quadriga, which stood on the summit of the building like that which was placed on the Mausoleum at Halikarnassos, in the disinterment of which he was engaged with Mr. Newton. The horses must have had bronze bits like those of the Mausoleum, as the holes in which they were fixed are still visible. The head of a female divinity—probably of one driving the chariot—was also found. The chests and portions of the legs, tails, etc., of the horses have also been brought to light. Sir John S. Lumley intends to continue the excavations during the winter; and should he be fortunate enough to recover the remainder of the group and the quadriga itself, the discovery will be one of the most remarkable of modern times. Six torsos of Roman warriors in cuirasses, togas, and girdles were dug up in the vicinity; but they seem not to belong to the quadriga group, as they are comparatively late in date and coarse in execution.

In the accompanying illustrations are shown the site of the diggings, with Civita Lavinia and the Campagna in the distance; one of the horses' heads—which, how-

runs McMichael's Creek. The ridge is formed by a main anticlinal and a synclinal folding shaped like a letter N, near the cave. The eastern limb of the synclinal fold is very short, and the crest of the hill is the top of the anticlinal fold principally. At one point is what appears to be a transverse faulting across the hill of from thirty to forty feet; by this a perpendicular cliff is formed facing southward, and in it is exposed, forming a magnificent arch in the strata of the Lower Helderberg limestone, the top of the anticlinal and its axis, into which, from the bottom of the cliff, extends the cave in a north-northeasterly direction. From its entrance is obtained a fine view down Cherry Valley, and along the base of the Blue Mountains.

When discovered, the entrance to the cave was nearly covered by the debris sloping up the face of the cliff, leaving only a small passageway, into which many adventurous persons had crawled from time to time.

The original cave was filled nearly to its top, and exploration was commenced by cutting a trench through the debris in front. The work had not progressed far before bones were found, and soon after implements of man's handicraft, the finds becoming more frequent and greater when the entrance to the cave was reached, and for fifty feet into it. Beyond this, for the two hundred feet further of exploration, nothing more was found. The passageway made was about six feet in height; a pit was also sunk eight feet deeper, at one point, but without finding the bottom rock, and the depth and length of the cave are unknown. It was filled to within three or four feet of the roof with a fine, unctuous clay, rather irregularly stratified, but very pure and homogeneous in quality. Upon this lies the



DISCOVERY OF ROMAN-REMAINS AT CIVITA LAVINIA (THE ANCIENT LANUVIUM). ITALY.

obtain the true therapeutic effects of coca, it is absolutely necessary that the cocaine be titrated at a fixed dose in all its preparations.—*N. Y. Med. Jour.*

RECENT DISCOVERIES AT CIVITA LAVINIA.

At the annual meeting of the Archaeological Institute at Newcastle, Mr. R. P. Pullan read a paper on some interesting discoveries, the result of excavations undertaken by him conjointly with Sir John Savile Lumley, H.B.M. Ambassador at Rome, in the spring of this year, at Civita Lavinia, the ancient Lanuvium.

Civita Lavinia is a walled town situated on a spur of the Alban Hills. Its fortifications are for the most part mediæval, and inclose only a portion of the ancient city. Lanuvium was celebrated for a temple of Juno Sospita. It was also the birthplace of Antoninus Pius and of Roscius. There are many remains of antiquity in and around the town. Among others, the *cella* of a temple, which Sir W. Gell supposed to be that of Juno. This, however, could not have been the case, as we know from ancient writers that the temple was surrounded by a grove, and the *cella* stands on the edge of a declivity, and close to a boundary wall and road of Etrusco-Latin times. Under the houses there are remains of a theater, where a fine statue of Claudius was discovered a few years ago. Mr. Pullan visited Civita Lavinia in 1879 with an eye to excavation, and then came to the conclusion that the temple of Juno Sospita had stood on a plateau about a quarter of a mile to the east of the present town. In the spring of the present year he mentioned his intention to excavate to Sir J. S. Lumley, who generously offered to aid him with money and influence.

After the discovery of the wall of the *temenos* of the

ever, does not fit the chest on which it has been placed; the head of the female divinity; the body of Naiad found in the building, which seems to have been a nymphæum; and a head of Jupiter, found in the Villa of Caligula, near Civita, which is also in course of excavation by Sir John S. Lumley and Mr. R. P. Pullan.—*London Graphic.*

ANCIENT BONE CAVE IN PENNSYLVANIA.

ONE of the most remarkable repositories of bones of our ancient fauna, in the Eastern United States, is known as Hartman's Cave, about five miles southwest from the Delaware Water Gap, and in the township of Stroud, Monroe County, Pa.

It has been intermittently opened and explored by Mr. T. Dunkin Paret, of Stroudsburg, during the past seven years, and numerous interesting implements of prehistoric man and bones of extinct species of animals have been exhumed; with these were also found the bones of animals not now inhabiting the vicinity, and also those of the present fauna. The bones and implements found were submitted to Dr. Leidy, of Philadelphia, for determination, and his remarks on the subject before the Academy of Natural Sciences of Philadelphia are published in the Proceedings for 1880.

The cave is along the axis of an anticlinal fold in the Lower Helderberg (Pre-Meridian) limestone, forming portions of the crest and the southeast flank of Godfrey's Ridge, which here attains an elevation of about 280 feet, and runs parallel with the range of the Blue Mountains; separated from it by the broad Cherry Valley. On the other (N. W.) side the crest is of Oriskany (Meridian) shales and sandstone, and the northwestern flank of Cauda-Galli grit (Post-Meridian), along which

stratum in which were found the bones and implements; its thickness is irregular, but it about half fills the remaining space. It is composed in part of stalagmite and of a gray friable heterogeneous mass of animal and vegetal debris, dust, sand, and calciferous matter, often cemented into masses by the infiltration of carbonate of lime in solution; above this there is considerable fine stalactical formation hanging from the limestone roof.

The implements found were considered very interesting by Dr. Leidy. The only stone implement was a large celt skillfully wrought from a hard brown slate. This was found in the layer of bone-earth some distance in the cave; all the other implements were of bone. A number of awls, some finely polished, were obtained from the debris at the entrance, and also in the cave signs of gnawing by small carnivores were prominent on some of them; but all were in a tolerably good state of preservation. An implement made from the prong of an antler, with a barb cut on one side, was found in the entrance of the cave, and "appears to have been used as a needle in mending nets." Near by was found a small implement much mutilated by gnawing; seems to have been similar to an ordinary needle, the eye or perforation part of which, however, had been gnawed away, the remains resembling a crochet needle. Another implement found was a bone fish-hook.

Evidences of man having inhabited the entrance to the cave were not numerous. Fragments of charcoal are quite abundant, and a large portion of the animal remains were in fragments and splinters, often of large bones, and generally bearing tooth-marks of the rodents or small carnivores which have gnawed them. Others appear to have been gnawed by larger carnivores; and others, as Dr. Leidy suggests, seem as if