enlarged. In this razor-grinder, I forgot to say that, on both sides, there were extensive adhesions, forming at the apex of each lung a cartilaginous cap. The appearances of the bronchial glands were exactly like the drawing placed underneath. On the other side, you have a very faithful representation of induration matter, with which the lungs are often found to be infiltrated—tough, solid, hardly to be cut, and in colour like a piece of gutta-percha. I regard the black discoloration of the lung and augmentation of its consistence as simply black pulmonary matter, with the superaddition of a morbid induration, which is altogether independent of it. I sent a portion of a dry grinder's lung to my late friend, in whom we all sustained so great a loss, Professor Hughes Bennett, who considered the black spots chronic exudation coloured with pigment. Some is in the smaller bronchial tubes, the black granular matter being deposited on the mucous membrane; much of it is either in cells, or exists in masses having all the characters of cells; some is in the vessels, and is probably altered blood. The enlargement of the bronchial glands is certainly the result of the chronic inflammation set up in the pulmonary tissue by which they are surrounded. The black pigment with which they are loaded differs not from the pulmonary parenchyma; and Dr. Sieveking has shown that it bears a close relation to the defective oxygenation of blood, manifest from the normal tendency to the deposit being greater in proportion as life advances, and in the attacks of chronic inflammation to which the grinders are so liable. I find that it accumulates in considerable quantities. The cartilaginous capsule, so often seen at the apex of the lungs, is by no means uncommon; under the microscope, to me it appeared to be of a fibrous—others have assigned to it a chondroid character.

With regard to the ages of grinders living and the ages at which they die, I have only to say I have no reason, from recent tests, to doubt what I have already stated, and that from personal observation. I found the average of all fork-grinders living (boys being included) to be 29; razors, 31; scissors, 32; edge-tool and wool-shears, 32. The stone on which shears are ground is soft and causes much dust.

Ages at Death of Fifty-four Grinders.—Under 20 years, four; 21 to 30, eleven; 31 to 40, fourteen; 41 to 50, fifteen; 51 to 60, seven; 61 to 70, 3; and of these 37 died of grinders' disease. In 1874, 92 grinders died, wet and dry; average age at death, 46 years. In 1875, 111 grinders died, wet and dry; average age at death, 42.5 years. I am indebted to my friend Dr. Griffiths, our very able Officer of Health, for these returns.

Wet Grinders.—We have yet, as far as grinders are concerned, to apply to these trades recent experiments as to the artificial production of tubercle; and in order to do this, to ascertain what this material is, and what the origin of it. Suffice it here to say, we know already that there is proof of the non-specific character of tubercle, which may have its origin in various causes, differing the one from the other.

The table-blade grinders, being wet grinders, work on the lowest floor of the wheel; they work in the coldest weather with their shirts open, thus fully exposing the chest—the coat, waistcoat, and neckerchief being put aside. Perspiring freely, they often go into the yard, attracted by something, and remain, heated as they are, out of doors without additional clothing. Inflammation of the lungs, pleurisy, rheumatic fever, diseases of the heart, are very common. I have at present one of these wet grinders under my care in the Public Hospital, with crippled heart and dropsy, after rheumatic fever.* The case of a table-blade grinder, who died some miles from Sheffield only ten days ago, under my care, well illustrated what takes place. A.B., aged 32, a table-blade grinder, about two and a half years ago caught cold, then had pleuro-pneumonia, of which disease I find exposure to cold the most common cause. It left him with a portion of the upper lobe of the right lung consolidated; and probably, as in almost all such attacks, there was considerable adhesion of the pleura. He recovered in part, but was left with a lung altogether unequal to its respiratory work. Of course, such a state of things must interfere with the nutrition of the body, and thus is prepared a certain way for the deposit of tubercle. His breathing was short, but he went to the wheel; had another attack during the winter, the health becoming more impaired. He had then cough, some slight hæmoptysis. He continued, notwithstanding his cough, difficulty of breathing, and copious muco-purulent expectoration, to creep to his hull and grind, until six weeks before he died. He only lived three days after I saw him, having a cavity of the right side, signs of softening on the left, and very great emaciation. No *post mortem* examination was allowed, or I would gladly, as I had hoped to do, have brought you a section recently taken from a grinder's lung. Sometimes, owing to the fibrous and contractile kind of exudation present, the lung does not give way; but such contraction causes great difficulty of breathing, owing to the obliteration of too great an extent of the breathing apparatus.

* Since dead. I hope to give full details of this very interesting case. The *post mortem* appearances were most instructive.

Can tubercle be produced by the inhalation of irritants? This is a question of no little interest. I think it can.

Prevention.—I am clearly of opinion that the means already exist. In a well ventilated room, with a properly constructed fan—or as the men say *fannie*—I have seen (a carefully contrived box being added) all the processes of the grinding trade, *i. e.*, shaping razors, grinding forks and scissors, hanging and racing stones—in a word, all the more dangerous processes of grinding, deprived of the power of causing irritation; all the dust having been driven up the shaft on to the outside of the building.

To prevent boys from entering the hull at an early age was what I at first set forth as an essential; and, although there has not as yet been time to witness the good effects, certain to arise from recent legislation, even in this our day, we have the satisfaction of knowing that no more youthful victims are in preparation for the grave; that no more boys can be driven into the wheel by their ignorant and besotted fathers to slowly perish—working with their hands at polishing, instead of with their brains under a master appointed by a school-board. Years slowly lingered on before my fellow-workmen and myself had the pleasure of reading one morning, in the *Times*: “Dr. J. C. Hall, by his persistent efforts for years on behalf of these poor men, has at last forced the public to listen to him”. Sad, sir, and disheartening—all but hopeless—seemed our task; when, year after year,

“All refused to listen:

Quoth they, ‘We bide our time’,
And the bidders seized the children,
Beggary, Filth, and Crime.”

The members of the Association have been invited to visit the works and grinding wheel of Joseph Rogers and Sons (limited)—a firm the reputation of which is world-wide. I beg of you to visit it and other like well constructed wheels. Contrast them with some of those graphic sketches from the *Illustrated London News*, the correctness of which I vouch for—accompanying as I did the artist. Compare them with wheels formed out of old houses, etc., too often destitute of all means to carry off the dust. Visit, compare, see, and judge for yourselves of the difference between a well constructed and a badly constructed wheel. Then, as it ought to be, let the verdict be yours, not mine, as to the value of a good fan in removing all dust, and so doing away with the serious consequences of inhaling irritants.

Calling to mind how, by proper treatment, we now prolong life in certain diseases of the lungs, contrasted with what was done more than five-and-thirty years ago, when I first joined the ranks, we cannot but regard it as one of our great victories. But, methinks, sir, there remains for us a greater victory still—the entire prevention of the injurious effects of mechanical irritants on the lungs of the industrious artisans of this our Fatherland.

[Diagrams were shown of the microscopical appearances of the sputa in wet and dry grinders; large photographs of sections of the lungs of dry grinders who had perished from the disease; and a bound copy of the *Illustrated London News*, with sketches of the grinders, wet and dry, at work—the description of each process being written by Dr. Hall.]

FRENCH MILL-STONE MAKERS' PHTHISIS.

By THOMAS B. PEACOCK, M.D., F.R.C.P.,

Senior Physician to St. Thomas's Hospital; Consulting Physician to the Victoria Park Hospital for Diseases of the Chest; etc.*

Some years ago, having had my attention attracted, both at St. Thomas's and the Victoria Park Hospitals, to the great prevalence of affections of the chest in the men employed in the manufacture of millstones from the “French burr”, or in the “French millstone-makers” or “builders”, as they term themselves, I took some pains to investigate the subject; and in a paper in the *British and Foreign Medico-Chirurgical Review* for 1860 drew attention to the very early age at which the men, when brought up to the trade, die from pulmonary disease; and showed that the injurious effects of the occupation were chiefly to be ascribed to the gritty particles which the men inhale while at work; and I detailed the particulars of two fatal cases, in one of which siliceous matter was found in the lungs.

Shortly after the appearance of that paper, a third case fell under my notice; and specimens of the lung, and microscopic slides and drawings prepared by Tuffin West, showing the siliceous matter in the consolidated lung-tissue, were exhibited at one of the meetings of the Pathological Society (November 16th, 1864), and a notice of the

* Read before the Medical Section at the Annual Meeting of the British Medical Association in Sheffield, August 1876.

communication is published in vol. xiii of the *Pathological Transactions*.

Since that time, several cases of the same kind have been under my care. Of these, one possessed very special interest from the pulmonary disease having coexisted with very marked symptoms of Addison's disease. This is, however, unfortunately imperfect, from the patient having died at a distance in the country; and I did not hear of the fatal event till it was too late to obtain a *post mortem* examination.

More recently, a case has occurred in the practice of Dr. Andrew, at the Victoria Park Hospital, in which siliceous matter was also found in the lungs. Of this I am able, by the kind permission of Dr. Andrew, to send a report to the Society.

CASE. Millstone Makers' Disease: Induration of lung and dilated bronchial tubes; small cavity at the apex of the left lung; enlarged and indurated bronchial glands; adherent pericardium; siliceous matter found in the lungs.—Thomas Stapleton, aged 45, a millstone maker, was admitted into the Victoria Park Hospital on October 25th, 1875. It appeared that he had been apprenticed to the trade of a French millstone-maker or builder, and had continued to follow the occupation all his life. His parents were both dead, and had died of acute diseases. He had been subject to winter-cough for several years, and, five years before his admission, had a severe attack of illness, said to be congestion of the lungs, with feebleness of the circulation. He, however, recovered from this illness, and continued well till May or June 1874, when he began to suffer from cough and vomiting of food. His symptoms were much aggravated about five days before his admission into the hospital.

When admitted, he had a severe cough and much muco-purulent expectoration, with difficulty of breathing, amounting to severe paroxysms at intervals. He was not, however, much emaciated, had a fair appetite, and the bowels were regular. He had never spat blood. He was very livid, and the extremities were cold. There was general flat-tending under the clavicles, with impairment of the resonance on percussion, especially at the left side; but there was not any marked increase of the cough or vocal resonance. There was also entire dulness on percussion, and absence of vocal thrill and of respiratory sounds at the right base, and much rhonchus in other parts of the chest. The pulse was rapid and feeble, and the action of the heart was much embarrassed. The point of pulsation of the heart could not be distinguished, and the sounds were feeble, but without murmur. He stated that he had lived a quiet and regular life.

He died exhausted on the 27th.

The *post mortem* examination was made by Mr. T. O. Bark, the resident medical officer, and Dr. West, the clinical assistant, and the following notes were furnished by Mr. Bark:—The body was somewhat emaciated; the hands and wrists were plentifully tattooed with the black and blue lines and marks characteristic of the patient's trade. The fingers were slightly clubbed. The left pleura was adherent over the whole lung, the adhesions being there red and easily broken down. The right pleural cavity contained about a pint and a half of clear serous fluid. There were old adhesions between the pericardium and the heart and vessels. The attachments were closer and firmer at the base of the heart, and looser and more easily torn towards the apex. The surface of the pericardium in the neighbourhood of the root of the right lung, and downwards along the posterior surface of the interventricular septum, was studded with black patches, varying in size and shape, some being very small elongated streaks, others as large as a bean. They were evidently in the substance of the pericardium, and in some places ran into a kind of net work, as if consisting of a deposit in the lymphatics. Similar patches were found in the right pleura.

The bronchial glands were much enlarged and of almost stony hardness, black, and firmly adherent to the surrounding tissues; and the glands in the course of the vessels at the root of the neck were in the same state. In the right bronchus, close to its origin, a gland pressed upon the passage, so as to produce a decided constriction; and in the left bronchus, corresponding to the seat of one of the glands, there was a small superficial ulcer.

On section of the right lung, a firm mass, spheroidal in shape, was found at the lower part of the upper lobe. It was about two inches in diameter, but was not distinctly separated from the rest of the lobe, the whole of which was tough, with the alveoli obliterated, and very dark. In the mass referred to there were one or two calcareous masses, the size of a cherry-stone. Lines of black pigment ran in all directions towards the pleura. Throughout the rest of the lung the bronchi and peribronchial tissue were thickened and deeply pigmented, and the fibrous septa of the lung were very well marked. The alveoli were large and exuded on pressure a frothy reddish serum.

The whole of the upper part of the left lung was also indurated, and in a similar condition to the right, except that the bronchial tubes were

very much dilated, the dilatations being lined by congested mucous membrane. At the upper part of the lobe there was a cavity about the size of a walnut, into which a large bronchus led, and which was lined by fibrous tissue, and partly contained caseous material. The rest of the lung was congested and emphysematous.

The heart was large, probably weighing twelve or fourteen ounces. Its substance was flabby, pale, and with yellow striae, especially towards the apex and in some of the columnæ carneæ. The cavities, particularly those of the right side, were dilated. The valves were natural. The pericardium was entirely attached by old cellular adhesions. The liver, spleen, and kidneys were congested, but not otherwise diseased.

Portions of the indurated lung were incinerated in the flame of a spirit-lamp till there remained only a white ash, and this was macerated in strong nitric acid for some hours. The residue, under the microscope, consisted of angular particles, exactly resembling the dust collected in the workshop.

A portion of the extremely indurated lung was subjected to chemical analysis by Dr. Bernays, in the laboratory of St. Thomas's Hospital, and yielded the following results: Water, 74.66; dried lung tissue, 25.34—total, 100.00. The dried lung tissue consisted of: Ash, 1.41 per cent., and this contained silex 0.387 per cent.

In illustration of this case, there were forwarded to the Society three naked eye specimens: a preparation of the more extreme degree of induration of the lung, one of the less marked degree of consolidation, and an enlarged and hardened bronchial gland.

Dr. Shepherd, my colleague at the Victoria Park Hospital for Diseases of the Chest, also allowed me to send to the meeting slides, showing the microscopic structure of the indurated lung, which he had prepared to illustrate his lectures at the Royal College of Physicians.

I have recently visited one of the largest manufactories of French millstones; and I find the injurious nature of the occupation, as before reported, fully confirmed by more recent experience. I am informed that the men, who are apprenticed to the trade as boys, rarely live beyond thirty or forty, and die with pulmonary symptoms, doubtless caused by the inhalation of the sharp siliceous dust and metallic particles which they inhale when leaning over the stones during their work. This, in persons previously of sound constitution, gives rise to chronic bronchial and bronchopneumonic affections, which lead to consolidation, and ultimately to breaking down of the lung-tissue; and, in persons predisposed to consumption, may probably call into active operation true tubercular phthisis.

The occupation is, probably, more injurious to young persons who have not attained their full growth and vigour than when the men take to it later in life. The injury is also much lessened, if the men, when they begin to find their health failing, change for a time to some other employment; and thus it happens that, in most of the yards, men will be found working who have attained greater ages than those named, and who are comparatively well; but such men are always found not to have entered on the work early in life, or not to have followed the occupation continuously. I fear also that the injurious nature of the occupation is often much aggravated by the intemperate habits of the men.

In 1862, when the Royal Commission sat to investigate the condition of the Metalliferous Miners, under the presidency of Lord Kinnaird, it was thought by some of the Commissioners that the very early age of invaliding and the high rate of mortality in the miners might be, in part, due to their inhaling particles of rock or metal while at work; and, under this idea, I was requested to investigate the subject. After, however, devoting much attention to the state of the miners employed in the deep copper and tin mines of Cornwall, I was led to conclude that this cause did not operate in a very marked degree to the injury of those men; and that the chief factors in the production of their unhealthy condition were—

1st. The impurity of the atmosphere in which the men work, especially when employed in the so-called "close ends", the air being deficient in oxygen and surcharged with carbonic acid, and with the products of combustion, respiration, etc.; this condition especially gives rise to the general debility and nervous prostration, and to the loss of appetite and dyspeptic symptoms, and to the low hectic fever, from which the miners commonly sooner or later suffer.

2nd. The heat of the deep workings, by which the men are tendered and made unduly susceptible to cold and damp, when exposed in the shafts and on coming to the surface; this causing various inflammatory affections of the respiratory organs, rheumatism, etc.; and

3dly. The overstrain of the heart and arteries in climbing the ladders, beating the borer, etc. At the time named, the almost universal means of access to and egress from the mines was by ladders, the man engine and skip being very rarely provided. In this way, the right

side of the heart becomes dilated, and not unfrequently valvular incompetency ensues.

In the lead mines of Cumberland, Northumberland, and Durham, the dust inhaled probably is a more important element in the production of the bronchial affections of the miners; indeed, they very generally complain of suffering from the "stour" when working in the soft-shales. The atmosphere of some of these mines is, however, apparently quite as bad as in Cornwall, though the workings are comparatively shallow; and so the men are equally subject to asthma and prostration of strength, and dyspeptic symptoms. As, however, ladders are little used, the mines being entered by day levels, or machinery being provided for access and egress, the miners appear much less liable to suffer from heart disease.

While in Cornwall, I had the opportunity of examining the body of a man who died at the age of fifty-five, and had been employed in the mines since he was thirteen or fourteen years of age. His health began to fail at about the age of fifty, and he became incapable of work at fifty-two. The left lung was emphysematous at the edges, and of a deep blue colour. The right lung was firmly adherent to the parietes, consolidated throughout, and with irregular cavities at the apex, containing a brown coloured fluid, but without anything of the nature of tubercle in any part. The lung-tissue was not found, on chemical analysis, to contain any siliceous material. The bronchial glands were enlarged, very hard, and of a deep blue colour. There was caries of the third left rib, and an abscess had formed. One suprarenal body was atrophied, so as to be reduced to little else than cellular tissue, and the other was converted into a cyst containing dark grumous fluid.

It is quite possible that some effectual mechanical means may be introduced by which the inhalation of the gritty particles by the millstone-makers may be lessened or prevented; and I have before suggested that, if the stones were worked wet, it would probably very much prevent the dust being thrown off and inhaled. I believe, however, that the most effectual relief would be gained by not allowing young persons to be brought up to the trade; and by only employing men who have attained their full growth. I have also long thought that a similar rule, as regards the metalliferous miners, would go far to lessen the amount of sickness and invaliding among them. In some of the mines, as those of the London Lead Company in the North of England, boys are not allowed to work underground before the age of sixteen, and only for three or four months during winter between that age and eighteen to nineteen; and the evidence of the resident medical men was conclusive as to the young people, so gradually seasoned to the work, suffering much less than those who commence to go under ground at earlier ages.

I do not know that the condition of the lungs has been carefully investigated in the chest-affections of the northern lead-miners; and cannot say whether, in their case, the gritty particles are commonly found in the lungs; but it is most probable that such is the case, as the workings are stated to be often extremely dusty.

DISEASES INCIDENT TO THE MANUFACTURE OF POTTERY.*

By JOHN T. ARLIDGE, M.D. Lond., F.R.C.P. Lond.,
Physician to the North Staffordshire Infirmary, Newcastle-under-Lyme.

AT the solicitation of the worthy President of this Section, I have put together some brief observations on the principal diseases incident to the manufacture of pottery, as a contribution to the series of essays which he has so very wisely sought to lay before the members of the British Medical Association, illustrative of the maladies attributable to the chief manufacturing processes carried on in this country.

Having on several previous occasions written on the same subject, it will be difficult to avoid repetition in the observations now submitted, for the materials constituting the basis for observation remain the same, and are in themselves necessarily limited.

The observations upon which the remarks and conclusions in this paper are based are written notes of 815 cases of disease occurring among those engaged in the various processes of the manufacture of earthenware and china, who came under my notice as out-patients of the North Staffordshire Infirmary.

This infirmary is, as you may know, the great medical institution for North Staffordshire, but, by its locality in Stoke, is pre-eminently the medical institution of the Pottery towns, containing a population of 120,000 individuals, of whom a very considerable proportion—just

about one-sixth—are engaged in the pottery manufacture; consequently the infirmary affords, by its very large out-patient department, as well as by its in-patient accommodation—amounting to 180 beds, most ample opportunities for observing the diseases prevalent among the artisans of the neighbourhood.

So much for the field of observation afforded me. It is further necessary for you to know something of the processes of the manufacture in question, so as to apprehend in some degree the mode in which those processes prove detrimental to health.

As a rough classification, they are divisible into the clay and finishing departments. The clay department comprehends all those processes concerned in the preparation of the clay for use, and in the moulding of the clay into the various objects, ornamental and useful, which we all know under the terms "earthenware and china". The finishing department comprises all processes employed in giving the glazed surface to the ware, and in ornamenting the surface with colours and gold. The firing of the ware in the ovens and the placing of it in the special boxes, technically called "saggars", made of coarse clay, wherein it is submitted to the fire and protected from smoke and other injury, may be regarded as intermediate processes. So perhaps might the "dipping" of the ware—that is, the covering of it with the glaze—be deemed an intermediate process; whilst, again, the "sorting" of the ware after it is withdrawn from the oven may be represented as a supplementary operation, neither appertaining rightly to the clay nor to the finishing department. Now, without puzzling my hearers with details and technical words, I may state that the working in the clay and the "dipping" of the ware are the divisions of labour most inimical to health.

The so-called clay is obtained from Cornwall and Dorsetshire, and is very rich in silica, consisting largely of decomposed granite. And, besides clay, more or less ground flint is used, especially in the making of china. In the manipulation of the clay in the processes called "throwing", "pressing", and "turning", and, in a considerable measure, by reason of the heat in the workshops, more or less dust is thrown off and diffused through the atmosphere. Hence it happens that the operatives in the shops are exposed to the inhalation of dust, consisting of mineral matters, silica, and alumina.

Again, the "dipping" consists in immersing the ware for a second or two, by means of the hands of the workmen, in the glaze, a thick liquid compound containing a large proportion of lead blended with borax and other matters. In this proceeding, therefore, there is exposure to the absorption of lead through the skin; but my belief is, that the poison is chiefly introduced into the system through the lungs by inhalation of the dust; for the glazed dries upon the surface of the ware almost immediately, and you will find the clothes of the workers and all surrounding objects in the workshop dusted over with a white dust, which is the same as saying that the surrounding air is more or less charged with the dust from the poisonous glaze. Men are employed in this work of "dipping", but are assisted by women or lads, who take the ware, when dipped, from the hands of the dipper, remove any excess of glaze from the surface, and put it aside to finish drying. But, with this process, the mischievous contact with the lead-solution does not cease, for another class of workmen are next in order called upon to handle the ware covered by its film of glaze, and to "place" it, or carefully dispose it in the earthen vessels—the saggars—in which it is to be fired. Hence it is that placers suffer equally with dippers from lead-disease. There are yet other processes in which lead is used; viz., where it is mixed with colours and dusted on the surface in a dry state, the process of "ground-laying", and where it is mixed with colour in a moist state and laid on by pencils in the colouring of the ware known as majolica.

The finishing branches of the trade are those of printing, painting, gilding, and burnishing; but these in themselves offer no source of disease other than what is represented by sedentary labour and exposure to hot, and too frequently ill-ventilated and overcrowded workshops. I need, however, mention a subsidiary branch of labour known as scouring, carried on by women, and consisting in the cleaning of china after it is drawn from the oven from the flint dust with which it has been covered. This unhappily is a very health-destroying proceeding, by reason of the dust given off in it, and its copious inhalation.

After this bare outline of the processes of pottery manufacture, you will not be surprised to learn that lung-disease, caused by the inhalation of mineral dust, is exceedingly prevalent among potters, and very destructive of life, killing them off, indeed, at an early age. From statistics I have worked out, I find that, whereas among the males of the population not engaged in the making of pottery the proportion of sufferers with bronchitis equalled 18 per cent., that of potters was a shade higher than 36 per cent.; and that, with regard to phthisis, whilst the proportion among the former was 13 per cent., it rose among the latter to 20 per cent. Now, it is the male workers who are espe-

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