REMARKS ON THE EFFECTS OF THE TRADES OF SHEFFIELD

ON THE WORKMEN EMPLOYED IN THEM: WITH SPECIAL
REFERENCE TO INHALED IRRITANTS.*

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At the repeated request of the President, Dr. Chadwick, I have consented to introduce to the members of the British Medical Association the all-important subject of the effects produced by inhaled irritants. I did not refuse at first to comply from any wish not to take a fair share in the discussion of a subject which, for more than a quarter of a century, I have made a special study. But, having given evidence before a Royal Commission and occupied many pages of a Blue Book of the House of Commons—after having spoken often, and again and again published the results of my gleanings on the diseases of the grinders and other workmen following like trades—nothing seemed left but to repeat myself. This subject, affecting as it does thousands of the working classes of this and other countries, is surely well worthy the careful investigation of an Association learned and powerful as this; and, I venture to think, even our amiable critic, dating from the “sad sea waves”, will hardly venture to apply to investigations such as we are engaged in this morning his proverbial “*cui bono?*” If we cannot altogether prevent these diseases of our industrious artisans, let us, at any rate, endeavour if possible to render them less deadly.

If a man spend a considerable portion of his time, day after day, in a room the atmosphere of which is constantly loaded with small dust-like atoms of coal, cotton, flour (millers') dust, and fine particles of foreign hair and dust, and if the most perfect and efficient means be not taken to carry off this dust, the serious effects of the mechanical irritation soon exhibit themselves. The girls employed in hair-seating, workmen in leather and flax, chaff-cutters, stone-masons, metal-miners, quarrymen, the machine-filers of Leeds, potters, needle-grinders, razor-grinders, scissor-grinders, fork-grinders, sheep-shears grinders, and, during some part of the process, table-blade grinders, all suffer more or less.

It would appear, from the observations of Dr. Holland, Medical Inspector, that metal-mining is more destructive of life than coal-mining; for metal-miners are destroyed by excessive lung-disease, shortening the average duration of their lives by nearly nine years, and the period of productive labour about one third. It is after the age of forty that the mortality becomes so enormous.

The question of inhaled irritants embraces a field so vast, so studded over with objects of interest, that all our time would be inadequate for its full investigation; and therefore is it that I shall this morning confine myself strictly to the effect produced by them on the Sheffield grinders. For a more minute description, I refer you to my published works.†

I shall divide grinders into *wet*, *dry*, and *mixed*. Those who use the wet-stone, those who use the dry, and those who work partly on a wet and partly on a dry-stone.

Wet Grinders.—Spring knives, files, saws, scythes; wool shears and edge tools; table knives, sickles.

Dry Grinders.—Forks, needles, brace-bits, spindles, table-knife bolsters, shanks, scissors.

I shall not have time to describe the interior of a hull, with its grinding troughs (“trows”), glazier, lap, polisher, drum, placed at the back part of the hull; and at once, therefore, will again refer you to my published works—contenting myself by remarking that, in years gone by,

I have attended boys dying from the effects of inhaling irritants, who had never ground, but had been only employed in polishing; in which process a dry powder called by the men “crocus”, but which is in fact an oxide of iron, is used. I must, however, refer for a moment—for this is productive of much dust—to what is called *racing* a stone. When the old stone is removed, much dust is created in sweeping up, in hanging, and in racing a stone. When the grinding stone comes from the quarry into the wheel, a hole is drilled through the centre, and, being fixed on the axle, it is made to revolve slowly in the trough, so that the steel may bite. The grinder then takes a bar of steel, and by it the asperities of the rough stones are removed and their surface rendered level and smooth. This process lasts for half an hour, and the room becomes filled with clouds of dust. When there is no proper fan, a light handkerchief tied over the nose and mouth is a great protection; but many grinders do not care to be at the trouble even of using it.

Causes of Grinders' Disease.—Scissor-grinding, fork-grinding, and razor-grinding are the most fatal. The razor, forged out of a bar of steel, is shaped upon a dry stone into the required pattern when in a soft state. The causes of the disease in dry grinders is, in the first place, the irritation produced by the metallic and gritty particles inhaled in *grinding*, and in *hanging*, and *racing* the stone. The bad atmosphere in which the men work must not be forgotten. Bad ventilation and its consequences—the breathing of hot, close, foul air, and the increased liability to catch cold after working in such an atmosphere—are frequent causes of the disease. Next come the constrained position in which these men have to work for hours; sitting upon what they are pleased to term their horsing (a low narrow bench); the elbows rest upon the knees; and, especially when grinding very small articles, the head is kept over the stone. The position is most injurious, and, when long continued, cannot but induce pulmonary congestion. If my views as to the pathology of the Sheffield grinders' disease be correct, I need not trouble gentlemen of your standing and experience with long details of the symptoms during life. After working some years at dry grinding, without the protection of a fan (however tolerant some may think that lungs are of foreign matters), the digestive functions become impaired; there is difficulty of breathing after the slightest exertion, and more or less inability to walk up the steps leading to the hull. The face is pale and pasty-looking; the countenance tells its “o'er true tale” of distress; there is a feeling of constriction across the chest, and a dry sensation at the back of the throat. To these symptoms succeed coughing; at first dry, then with frothy expectoration, indicative of irritation. The physical signs of the Sheffield grinders' disease, as I have observed them for many years in hospital, dispensary, and private practice, are in some patients those of bronchitis and dilated bronchi; in others of emphysema or consolidation; and we have, lastly, excavation. In many cases the physical signs are not quite in proportion to the extent of the disease, the diagnosis of which, however, is no longer difficult, when the nature of the occupation is known.

I will now direct attention to the diagrams before us, of the expectoration in wet and dry grinders. The objects in each circle were first magnified 250 diameters, and afterwards enlarged last week, for our present purpose, with the photograph. I need hardly remind you that the appearance of such expectoration varies with the length of time the grinder has left the wheel before it was procured.

Expectoration from a Wet Grinder.—At the top, you will notice curled elastic lung-fibre and cells containing pigment; immediately below, pus and mucus-cells, some transparent, showing a nucleus, others loaded with pigment.

Expectoration of a Fork-Grinder.—Epithelium from the mouth, epithelium from the fauces, particles of gritty stone, particles of metal, blood-corpuscles, pus, and mucus-cells. Taken on leaving the hull.

Post mortem Appearances.—So far as I have been able to discover, the general appearances of the lungs of those who have died of grinders' disease are such as we see in ordinary cases of chronic inflammation. Although I have often discovered particles of grit, I have never, after the most careful microscopical examination, detected a particle of steel. It may economise our time, if I direct attention to these diagrams which most accurately exhibit the appearances of sections of a dry grinder's lung and bronchial glands. The whole of the superior lobe of each lung is often dense as in this, and of a dark-grey colour. The external surface is sprinkled over with small black spots, which will vary in size from that of a split No. 3 shot-corn, to a kidney-bean. To cut into the solidified lung is often a task of some little difficulty. Here, beneath the surface, are seen similar black bodies; and I have examined cases in which these have been gathered into masses of very large size. In this section of lung (which was taken from a razor-grinder), one near the bifurcation of the trachea was fully as large as a hen's egg. You also find the bronchial glands blackened and

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† A series of papers in the BRITISH MEDICAL JOURNAL: “The Sheffield Grinders' Disease, with many Microscopical and other Illustrations” (Longman and Co.); “The Trades of Sheffield, as Influencing Life and Health”, read before the National Association for the Promotion of Social Science (Longman and Co., second edition). A series of articles in the *Times*; Descriptions of the Sheffield Hulls, for the sketches in the *Illustrated London News*, 1866, of File, Razor, Fork, Table-Blade, Scythe, Saw-Grinding, and File-Cutting; Evidence given (see Parliamentary Blue-Book of the House of Commons).

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.

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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

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