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Wallace
Fonatne
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Walther von der Vogelweide
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Weber
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Fechner
Fichte
Weiße Rose
von Fallersleben
Kant
Ernst
Frommel
Richthofen
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Tacitus
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Dostojewski
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Lichtenberg
Rathenau
Trackl
Stevenson
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Hambruch
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Mommsen
Lenz
Droste-Hülshoff
Thoma
Hanrieder
Dach
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von Arnim
Hägele
Hauff
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Karrillon
Rousseau
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Gautier
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Darwin
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Campe
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Voltaire
Federer
Bismarck
Vigny
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Roth
Heyse
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Horaz
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Machiavelli
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An Investigation into the Nature of Black Phthisis or Ulceration Induced by Carbonaceous Accumulation in the Lungs of Coal Miners

Archibald Makellar

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AN INVESTIGATION

INTO THE NATURE OF

BLACK PHTHISIS;

OR

ULCERATION INDUCED BY CARBONACEOUS ACCUMULATION

IN

THE LUNGS OF COAL MINERS,

AND OTHER OPERATIVES.

BY

ARCHIBALD MAKELLAR, M.D., F.R.S.S.A.,

FELLOW OF THE ROYAL COLLEGE OF PHYSICIANS OF EDINBURGH; MEMBER OF THE MEDICO-CHIRURGICAL SOCIETY, OF THE HARVEIAN SOCIETY, OF THE OBSTETRICAL SOCIETY, ETC. ETC., AND ONE OF THE PHYSICIANS TO THE NEW TOWN DISPENSARY OF EDINBURGH.

PREFACE.

An abstract of the investigations into the nature of carbonaceous infiltration into the pulmonary tissues of coal miners, was read by Dr Makellar at a meeting of the Medico-Chirurgical Society of Edinburgh, Wednesday, 8th July, 1845, Dr Gairdner, President, in the Chair.

Reference was made, in particular, to the East Lothian coal-miners. The carbonaceous disease described, was stated to be caused by the inhalation of substances floating in the atmosphere of the coal-pit, such as the products of the combustion of gunpowder, the smoke from the miner's lamp, and the other foreign matters with which the air of the mines is heavily charged, in consequence of their defective ventilation. In the mines in which gunpowder is used, the disease is most severe in its character, and most rapid in destroying the pulmonary tissue. The carbon in some cases is expectorated in considerable quantity for some time previous to death; in others, it is retained, and accumulates to a great extent in the lungs.

As the disease advances, the action of the heart becomes feeble; and the appearance of the blood indicates a carbonaceous admixture. The carbonaceous deposit seems to supersede or supplant the formation of other morbid bodies in the substance of the lungs—such as tubercle; for in individuals belonging to families in which there exists an undoubted phthisical diathesis, tubercle is never found on dissection.

The views expressed in this communication called forth the following remarks.

Professor Christison called attention to the new and important fact, of the carbonaceous matter being found in the circulating mass. He attached great importance to Dr Makellar's researches.

Professor Allen Thomson remarked, that the presence of this carbonaceous matter in the blood, by no means proved, that it was formed in, or from the blood.

Dr Hughes Bennett said, that the antagonism of this carbonaceous disease to tubercle, was a fact of great interest and importance, es-

pecially in connection with two other recent observations; viz. 1st, That the depositions of carbon in the lungs of old people, (which French pathologists describe,) are not found associated with tubercle; and, 2d, That under the supposed cicatrices of pulmonary tubercular cavities, a layer of carbonaceous matter is commonly found.

Dr Makellar's paper called forth some interesting observations from the President, Professor Simpson, and others. [Pg 1]

BLACK PHTHISIS,

OR

ULCERATION INDUCED BY CARBONACEOUS ACCUMULATION IN THE LUNGS OF COAL-MINERS

Among the many diseases incident to the coal-miner, none come oftener under medical treatment, than affections of the respiratory and circulating organs. While the collier is subject—during his short but laborious life—to the other diseases which afflict the labouring classes in this country, such as inflammations, fevers, acute rheumatism, and the various eruptive diseases, he, at last, unavoidably, falls a victim to lesions within the cavity of the chest, arising from the nature of his employment. In the present communication, it is proposed to lay before the profession a series of remarks, which I have been enabled to put together, with a view to elucidate the cause and progress of that very peculiar pulmonary disease, incident to coal-miners, which I shall denominate Black Phthisis, or Ulceration induced by Carbonaceous Accumulation in the Lungs.

The rise and progress of the malady may be thus sketched: A robust young man, engaged as a miner, after being for a short time so occupied, becomes affected with cough, inky expectoration, rapidly decreasing pulse, and general exhaustion. In the course of a few years, he sinks under the disease; and, on examination of the chest after death, the lungs are found excavated, and several of the cavities filled with a solid or fluid carbonaceous matter.

During the last ten years, my attention has been much directed, in the course of my professional labours in the neighbourhood of the coal-mining district of Haddingtonshire, to the above pheno [Pg 2] mena in the pathology of the lungs, which have not hitherto been brought so fully before the profession, as their importance demands. The subject presents a very interesting field of investigation to the physiologist and pathologist.

When we consider the difficulties which the medical man has to encounter, in prosecuting his researches in morbid anatomy in a mining district, it is sufficiently explained why the peculiarly dis-

eased structures in the body of the coal-miner should have been left so long uninvestigated.

Not many years ago, the obstacles in the way of *post mortem* examinations among colliers were insurmountable, and consequently, till lately, few medical men could obtain permission to examine, after death, the morbid appearances within the chest of a collier. With the rapid advance in the general improvement which has been going on, the collier's position in society has become greatly elevated; and his deeply-rooted superstitious feelings have been, to a great extent, dissipated. Let us hope that the school-master will find his way into every collier's dwelling, enlightening his too long uncultivated mind; and that the foolish prejudices shall cease, which have been hitherto the barriers to *post-mortem* examinations in his community.

The only medical writers, as far as I am aware, who have brought this subject before the notice of the profession, are, Dr J. C. Gregory, in the report of a case of peculiar black infiltration of the whole lungs, resembling "Melanosis," (*Edinburgh Medical and Surgical Journal*, No. cix., October 1831); Dr Carsewell, in an article on "Spurious Melanosis," (*Cyclopædia of Practical Medicine*, Vol. iii); Dr Marshall, in a paper in *The Lancet* for 1836, entitled "Cases of Spurious Melanosis of the Lungs;" Dr William Thomson, now Professor of Medicine in the University of Glasgow, in two able essays (*Medico-Chirurgical Transactions of London*, Vols. xx. and xxi.), wherein he gives a number of very interesting cases, collected from various coal districts of Scotland, illustrating different forms of the disease; Dr Pearson, in the *Philosophical Trans.* for 1813, on the "Inhalation of Carbon into the Pulmonary Air Cells;" and in a paper, by Dr Graham, in vol. xlii. of the *Edinburgh Medical and Surgical Journal*.

Recently, professional and other writers have directed attention to the influence of various occupations in the production of diseases of the chest. The pernicious employment of the needle-pointers, razor and knife-grinders of Sheffield, and other manufacturing towns in England, [1] have not only engaged the attention of the public at large, but science has been at work to ascertain, with as much accuracy as possible, the relative effects of the different avocations, on the constitutions of those occupied in these destructive

employments. Researches of this nature tend much to the [Pg 3] well-being of society, as they make us acquainted with the maladies and sufferings peculiar to certain classes of our fellow-men; and point out, also, the causes of their early decay, and premature death. The coal-miners—those in whose behalf I would now solicit the intervention of science—are most valuable in their place, and their exhausting labours promote, in no small degree, our domestic comforts.

Some of the diseases of colliers have in past time been very much overlooked by the medical inquirer. There has been, within the last few years, a very searching investigation as to the employment of women and children in coal-mines; and by the laudable exertions of Lord Ashley—a nobleman whose name shall ever be honoured among miners, and by all who have the true interests of that community at heart—an Act of the Legislature has been passed, declaring it unlawful for any owner of any mine or colliery whatever, to allow any female to work therein; and also enacting, that no boy under the age of ten years can be employed in mines. It is to be regretted, however, that his Lordship did not embody in his measure, provisions enforcing the free ventilation of mines under government inspection; for nothing would tend more to improve the health of those employed in them.

In the course of the inquiry, which formed the prelude and basis of Lord Ashley's Act, much valuable information regarding the diseases of colliers was elicited; and no one can peruse the voluminous parliamentary report pertaining to these investigations, without being struck with the very general prevalence of affections of the chest among miners. It is to be hoped, that the interesting facts in regard to disease, which this recent most necessary investigation has laid open, will be the means of directing the attention of scientific men to the subject, with a view to obviate, as far as human efforts can, the evils which have been exposed. It may at first appear difficult, to point out the means of removing effectually the causes of the pulmonary carbonaceous disease of miners, but, be the difficulties what they may, humanity encourages us to make the attempt.

In the *first place*, let us endeavour to ascertain the cause, and *secondly*, to suggest means for the mitigation or prevention of this scourge.

My present remarks do not refer to coal-miners in general, but to a district in Scotland, in the Lothians, east of the river Forth, where the labour is hard, and where its severity is in many cases increased by a want of proper attention to the economy of mining operations. These operations, as at present carried on, are extremely unwholesome, and productive of diseases which have a manifest tendency to shorten life. I draw the materials of my description from what I saw in a part of that district referred to, where the various cases, hereafter to be adduced, came under my medical treatment, and where I had the privilege of examining the morbid appearances after death. [Pg 4]

The locality [2] in which my observations were made, is that part of the Lothians, extending from south to north, stretching from the foot of the Lammermoors towards the sea-coast, including the coal-works of Preston-Hall, Huntlaw, Pencaitland, Tranent, and Blindwells. In this range of the coal-formation, the seam of coal is variable, but generally exceedingly thin, varying in thickness from eighteen inches, to three or four feet. It is with difficulty that mining operations can be prosecuted, from the extremely limited space in which the men have to move, and from the deficient ventilation. It appears, after thorough investigation, that in the majority of the coal mines above mentioned, ventilation is very much neglected, and that this neglect is partly caused, by the immunity of these mines from carburetted hydrogen gas, which exempts them from the danger of explosion. But though there be no explosive gas, there is generated, to a certain extent, in the more remote recesses of the pit, carbonic acid and other gases, producing the most injurious effects—impairing the constitution by slow degrees, and along with the more direct cause (the smoke from the lamp, candle, and the product of the combustion of gunpowder,) making progressive inroads on the health of the unfortunate miner. And how, I ask, can it be otherwise, in such circumstances? So long as it is possible for him to go on—so long as there is air enough to support the combustion of the lamp or candle, the labourer must proceed with his toil. I say, from there being no fire-damp, less attention is paid to ventila-

tion, and it is a common occurrence with colliers in these localities, to be obliged to leave their work, from there not being a sufficiency of oxygen to keep their lights burning, and support respiration; and this temporary cessation of labour under such circumstances is regarded as a hardship by some proprietors, while the bodily sufferings of the miner, shut up and necessitated to labour in this situation, are little considered.

After labouring beyond a given time in those confined situations, there is a much freer action of the respiratory apparatus, the oxygen is considerably exhausted, and to make up for this deficiency, the volume of air inspired, (impure though it be,) is much greater. Every now and then, there is a disposition to draw a deep breath, followed by a peculiar and gradual decrease of strength. Therefore, in these forcible expansions of the chest, it is to be expected that a considerable quantity of the floating carbon will be conveyed to the cellular tissue.

The atmosphere of the coal mine at length becomes so vitiated, by the removal of the oxygen in breathing, and the substitution of carbonic acid, that the respiration becomes gradually more difficult, and the exhausted labourer has ultimately to retire from the pit, as there is no other mode by which the noxious air can be removed—owing [Pg 5] to the underground apartments being so small—than by gradually allowing purer air to accumulate. The miner is thus enabled to return to his employment.

It is about thirty years since miners in this district adopted the use of coarse linseed oil, instead of whale oil, to burn in their lamps; and it is very generally known, that the smoke from the former is immensely greater than that from the latter, and many old miners date the greater prevalence of black spit to the introduction of the *linseed* oil. This change took place entirely on the score of economy. Any one can conceive how hurtful to the delicate tissues of the respiratory organs, must be an atmosphere thickened by such a sooty exhalation.

It is now known, that this disease originates in two principal causes, viz., *First*, The inhalation of lamp smoke with the carbonic acid gas [3] generated in the pit, and that expired from the lungs; *Second*, Carbon, and the carburetted gases which float in the heated

air after the ever-recurring explosions of gunpowder, which the occurrence of trap dykes renders necessary.

To those acquainted with mining operations, an explanation of the coal and stone hewing process is unnecessary; but, for the sake of the uninitiated, I may be allowed to state, in explanation, that, previous to any coal hewing, it is needful to remove various strata of stone, to open up road-ways, and break down obstructing dykes, by the aid of gunpowder. All coal-miners are engaged exclusively with one or other kind of labour; that is either in removing stone or coal: and the peculiar disease to which each class is liable, varies considerably, according to the employment. For instance, the disease is more severe and more rapid in those who work in the stone, than in those engaged in what is strictly coal-mining, while, at the same time, both ultimately perish in consequence of it. The fact of the disease being more acute in stone-miners, I am disposed to attribute to the carbon and other products of the combustion of gunpowder, being more irritating and more destructive to the lungs. A very striking instance of this occurred, a few years ago, at the colliery of the Messrs Cadell of Tranent. A very extensive coal level was carried through their coal field, where a great number of young, vigorous men were employed at stone-mining, or blasting, as it is called, every one of whom died before reaching the age of thirty-five years. They used gunpowder in considerable quantity:— and all expectorated carbon.

It was long a very general belief with medical writers, that the various forms of discoloration in the pulmonary tissue was induced by some peculiar change taking place in the economy or function of secretion, independently of any direct influence from without. They were, therefore, usually supposed to belong to the class of melano [Pg 6] tic formations, from presenting, as their distinguishing feature, a greater or less degree of blackness. But, by recent investigations, it has been proved, that the infiltrated carbon found in the bodies of coal miners is not the result of any original disease, or change taking place within the system, [4] but is carbon, which has been conveyed into the minute pulmonary ramifications, in various forms, during respiration; and which, while lodged in these tissues, produces irritation, terminating in chronic ulcerative action of the parenchymatous substance. The very minute bronchial ramifica-

tions first become impacted with carbon, and consequently impervious to air; by gradual accumulation, this impacted mass assumes a rather consistent form, mechanically compressing and obliterating the air-cells, irritating the surrounding substance, and promoting the progressive extension of the morbid action, till the whole lobe is infiltrated with carbonaceous matter, which, sooner or later, ends in ulceration and general disorganisation of the part. It is evident, in tracing the disease through its various stages, up to that of disorganisation, that wherever there is an impacted mass in any part of the pulmonary structure, this is followed, sooner or later, by softening, from its irritating effects upon the tissues by which it is surrounded; and as this softening process advances, the innumerable sets of vessels [5] composing the dense network of capillaries are broken down, extending the cyst, so that, as the cysts enlarge, they gradually approximate to each other, till all at last become merged in one great cavity.

The majority of colliers, soon after they engage in their mining operations, become afflicted with bronchial disease to a greater or less extent.

Those who are hereditarily predisposed to pulmonary irritation, are, it is my decided belief, more liable to "black phthisis" than others; but I cannot suppose it possible, that any constitution, however robust and sound, could resist the morbid effects resulting from carbon deposited in the lungs. Tubercular phthisis is not at all prevalent in any collier community with which I am acquainted, only occasional cases occurring, and that amongst females. It is my impression, that a phthisical person, engaged in the operations of a coal-pit, similar to those in Haddingtonshire, would come under the influence of the carbonaceous disease, instead of the true phthisis; for, in all the *post-mortem* examinations which I have conducted, connected with this pulmonary affection, I have never found tubercular deposit:—while other members of the same family, having a like predisposition, and who never entered a coal-pit, have died of phthisis. Can carbon inhaled destroy a tubercular formation? I never knew or heard of a case of black spit in a [Pg 7] female collier, and this is accounted for by the circumstance, that the women, when permitted to labour, previous to the late prohibitory enactment, were only occupied as carriers; and from their movements

towards the pit shaft, in transporting the coals, were enabled to inhale at intervals a purer atmosphere. The boys also, who were employed as carriers to the pit shaft, continued to labour with like impunity, from their occasional change of situation; but the miner, lying on his side in a confined, smoky recess, under ground, gasping for breath, proceeding with his exhausting labour, cannot fail, in his deep inspirations, to draw in the deleterious vapour, to the most minute ramifications of the pulmonary structure, and, as he daily repeats his employment, so does he daily add to the accumulation of that foreign matter which shall ultimately disorganize the respiratory apparatus. In the first stage of the affection, there is an incessant dry cough, particularly at night, and all the prominent symptoms of bronchitis are present. Indeed, from the time a man becomes a coal-digger, and inhales this noxious air, [6] there is ever after a manifest irritation in the lining membrane of the respiratory passages, which is apparent before carbon in any quantity can be supposed to be lodged in the lungs. The mucous membrane of the air passages, by its continually pouring out a viscid fluid, has the power of removing any foreign matter that may be lodged in them. Now, should this membrane, owing to previous irritation, lose to a certain degree this secretory power, then the foreign body adheres to it, and is retained, and this, I think, constitutes the preparatory stage of black deposit. In tracing the progress of the disease, it is my belief, that immediately after the carbon is established in the air-cells, the absorbents become actively engaged, and the glandular structure soon partakes of the foreign substance. One of the peculiar features, as we shall find, when we come to describe cases, is, that the secretory function is ever after so changed in its character, that the gland which formerly secreted mucus, to lubricate the passages, now performs the same service with muco-carbon, and continues to do so during the remainder of the patient's life—even, as I have often seen, long after he has desisted from the occupation of a coal-miner. In fact, it constitutes a striking peculiarity of this disease, that when the carbon is once conveyed into the cellular tissue of the lung, that organ commences the formation of carbon, thus increasing the amount originally deposited, as was strikingly exemplified in the case of Duncan and others, to be afterwards detailed. Duncan had not for fifteen years been engaged in mining operations, nor was there any possibility of his having inhaled more carbon: yet in

him it was found to have increased to the greatest possible extent, leaving but a small portion of useful lung. [Pg 8]

I have been long impressed with the belief, that the carbon is contained in considerable quantity in the blood, particularly in the blood of those far advanced in the disease. This impression arises, not only from its dark and inky appearance, but from its sluggish flow, and non-stimulating effects on the heart and general system; and when we examine the morbid condition of the pulmonary structure,—ascertain the presence of carbon in the glandular system and minute lymphatic vessels of the lungs, and consider the relation existing between them and the circulating fluid, we cannot suppose it possible, that such a mass of foreign matter should be lodged in their parenchymatous substance without imparting a portion to the blood. I was never more struck with this, than in the case of Duncan, where the blood was more like thick brownish ink than vital fluid.

No one who has witnessed the economy of these pits, can doubt the inhalation, to a great degree, of lamp and gunpowder smoke into the pulmonary tissue. What may be its chemical action there, is a question for us to attend to as we proceed. If it be considered an established fact, that carbon is inhaled, possessing all the chemical qualities of that substance found floating in the air of the coal-mine, and either expectorated from the lungs during life, or retained in those organs till after death, we cannot but conclude, that the black matter is the result of an external cause, and that that cause is the sooty matter.

Another question arises here, in connection with this phenomenon, viz.—Does the carbon increase in the pulmonary tissues after the collier has relinquished the occupation of a miner, and when there can be no further inhalation, and if so, whence comes this increase? It must be admitted, judging from several of the cases which follow, that it does considerably augment. From this remarkable fact, does it not appear probable, that when carbon is once lodged in the pulmonary structure by inhalation, there is created by it a disposing affinity for the carbon in the blood, by which there is caused an increase in the deposit of carbon, without any more being inhaled.

Appearances on Dissection. In classifying the morbid appearances observed in the pulmonary structure, I arrange them according to divisions corresponding to three stages of the disease. *First*, Where there exists extensive irritation of the mucous lining of the air passages; and the carbon being inhaled, is absorbed into the interlobular cellular substance, and minute glandular system, thereby impeding the necessary change upon the blood. *Secondly*, Where the irritative process, the result of this foreign matter in the lungs, has proceeded so far, as to produce a variety of small cysts, containing fluid and semi-fluid carbonaceous matter, following the course of the bronchial ramifications. *Thirdly*, Where the ulcerative process has advanced to such an extent, as to destroy the cellular texture, and produce extensive excavation of one or more lobes. [Pg 9]

Stethoscopic Signs.—In the early stages, the sounds indicate a swollen state of the air-passages, and vary in character according to the part examined. The whistling and chirping sounds are loud and distinct in the large and small bronchial ramifications, and both from the absence of expectoration and the presence of the pulmonary bruit, the highly irritated state of the mucous linings is apparent. The affection ultimately assumes a chronic form, and continues present in the respirable portions of the organ during life. As the carbonaceous impaction advances, the sounds become exceedingly dull over the whole thoracic region, and in many of the cases no sound whatever can be distinguished. Where the lungs are cavernous, it is very easy to discover pectoriloquy, from the contrast to the general dulness, and when pleuritic and pericardial effusion advance much, it is difficult to ascertain the cardiac action.

Such is a short account of the *Cause*, *Progress*, and *Morbid Appearances* of this deadly malady, as they came under my notice.

From a variety of cases to which my attention was directed, I I have selected *ten*, with the *post-mortem* appearances in nine of them. These cases extend over a period of eleven years, all of them exhibiting, with some slight variation, the same character of disease, and proceeding from the same cause—inhalation of carbonaceous matter. Some of the cases occurred as far back as the years 1833-34, while the last case came under my notice within these twelve months. Of the ten patients, six were engaged at one period with

stone-mining, and four were entirely coal-miners; eight expectorated carbonaceous matter, and two did not show any indication of black infiltration from the sputum; six exhibited, on examination, most extensive excavations of the pulmonary structure; and three only general impaction of these tissues, with numerous small cysts containing black fluid; the body of the tenth, I regret to say, was not examined, owing to neglect in communicating in time the death of the patient, which took place a few weeks ago. These morbid appearances exhibit three stages of the disease in regular progression. The first is that where the carbon is confined to the interlobular cellular tissue, and minute air-cells, producing cough, dyspnœa, slight palpitation of the heart, and acceleration of pulse, while, at the same time, the patient continues able to prosecute his daily employment. The respiratory sounds, in this state of the chest, are loud and distinct. Such a condition of the pulmonary structure is often found on examination in the Carron *iron-moulder*, who has been killed by accident, or has died from some other disease, having been subjected in the course of his employment to the inhalation of carbonaceous particles.

The second is that stage where the softening has commen [Pg 10] ced in the several impacted pulmonary lobular-formed small cysts throughout the substance of one or more lobes, the contents of which may either be expectorated or remain encysted, giving rise to most harassing cough, laborious breathing, and palpitations, dull resonance of chest, and obscure respiratory murmur. The third and last stage, is that in which the several cysts in one or more lobes have approximated each other, forming extensive excavations, the prominent symptoms of the disease becoming considerably aggravated, and the powers of the system sinking to the lowest degree of exhaustion.

Case 1. George Davidson, collier from his youth. When I first saw him professionally, in May 1834, he was aged thirty-two. From his earliest years he was employed about the coal-works in Pencaitland parish, and when very young, he went down the pit to assist in conveying coals to the shaft, and ultimately became a coal-miner. For a considerable length of time, he enjoyed good health, having neither cough, nor any other affection. He was well-formed, and robust in constitution. A few months previous to my seeing him, he

had taken to the employment of stone-mining in the pit at Huntlaw, where he was accustomed to labour, and soon after being so engaged, he began to complain of uneasiness in the chest, and troublesome short cough, quick pulse, especially at night and in the morning, for which he sought medical advice, and was treated for bronchial affection. He continued to prosecute the employment of stone-mining in this coal-pit so long as his strength would permit, which was a little more than two years, when (August 1836) he was entirely disabled, from general exhaustion. By this time his cough had much increased, and there was considerable dyspnœa, accompanied with sharp pain in the thoracic region, both in walking quickly, and when lying down. Pulse 80. He expectorated bloody tough mucus without any tinge of black matter. All remedial means were adopted with a view to the removal of the irritation of the chest, without producing any very decided effect. The thoracic pain was occasionally subdued, but the cough became incessant; loss of appetite, rapid emaciation, and cold nocturnal sweats, with slow weak pulse, supervened. After a severe fit of coughing, during one of his bad nights, the black expectoration made its appearance, in considerable quantity, by which his sufferings were for a few days alleviated, when the cough returned in the same degree of severity, and was again mitigated by the black sputa, which was expectorated without difficulty, and from this time (October 1836) there was no interruption to a free carbonaceous expectoration.

In the early part of this man's illness, the stomach, the alimentary canal, biliary and urinary secretions, continued unimpaired; but as the cough advanced, gastric irritation, which was followed [Pg 11] by vomiting during the paroxysms, annoyed him; and for the last eight months of his life, he suffered occasionally from severe attacks of gastrodynia, which, when present, had the effect of considerably modifying the thoracic irritation, and allaying the cough. There was nothing very remarkable in the character of the urine; the quantity voided was small, and very high coloured, with occasionally a lithic deposit. The fæces were natural, and smeared with dark blue mucus. On examining the chest with the stethoscope, the crepitant ronchus was heard in the upper part of each lung. There was general dulness throughout the lower part of both, with the exception of a small space at the inferior angle of the left scapula, where pec-