

THE UNIVERSITY of EDINBURGH

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A S B E S T O S I S.

being

A T H E S I S

submitted by

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for

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of

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A S B E S T O S I S.

AN INVESTIGATION into the CHRONIC PULMONARY DISEASE of ASBESTOS WORKERS IN THIS COUNTRY.

The Asbestos Industry, being comparatively young, plays but a modest part in the Nation's activities as a whole. That would appear to be the only excuse for the even more modest position which it holds in the literature of Medicine.

It is from the clinical aspect that I have perforce studied the effects of this industry on those employed in it, for it is in the course of General Practice alone that I have access to the subject.

My attention once aroused by the frequent occurence of intractable pulmonary disease amongst my patients working in a local asbestos factory, I soon found that not only do the workers regard their occupation as almost inevitably productive of Phthisis in the long run, but that the employers are so wide awake to the risks as to establish and enforce precautionary measures on a scale far beyond the requirements of the Factory and Work Shops Act.

If I have been afforded some opportunity of observing the conditions under which my patients are

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are/
employed, it has been entirely due to the courtesy and enthusiasm of the management at Leeds.

I have no official status.

ASBESTOS was first used over two thousand years ago when, even then, its fire-resisting properties were known to the ancients. (Ref.1.)

Herodotus (circa 450 B.C.) describes a cremation cloth made of it.

Pliny (circa 50 A.D.) writes of the difficulty of weaving it. Strabo (circa 30 B.C.) and Plutarch (circa 70 A.D.) both mention that the wicks of the lamps of the Vestal Virgins were made of Asbesta - so called because they maintained a perpetual flame without being consumed.

In the Thirteenth Century, Marco Polo refers to a fire-resisting cloth which he thought was made from Salamander skins (universally supposed to be immune then.).

Nothing more is heard of it until experiments were made in Lombardy by two investigators who discovered that a kind of cloth could be made from the mineral, for which enterprise they were honoured and encouraged by Napoleon I; but in consequence of the state of unrest in Europe, hardly any progress or development was made until 1866 when Signo Albonico, Canon Del Corona, and the

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Marquis di Baviera made experiments which resulted in the production of asbestos cloth and paper.

The industry was established in this country about fifty years ago and is growing more important every year.

THE CRUDE MINERAL is merely a piece of rock or stone.

'It has truly been called a physical paradox being both fibrous and crystalline, elastic and brittle, yet able to be carded and so converted as to be spun and woven like wool, flax, or silk.

It would appear to possess the characters of both vegetable and mineral while being different from either; light and feathery as eiderdown, it is yet as dense and heavy as the rock it resembles.

Older than anything in the animal or vegetable kingdoms, but so little affected by the influences of time that untold centuries, by which the hardest rocks have crumbled away, have had no appreciable effect upon the asbestos contained in them.

The fiercest heat fails to consume it, nor acids affect the strength of its fibres notwithstanding their delicacy; a strand of it can be spun to weigh less than one ounce per hundred yards length and fine cloth can be made from its fibres weighing only a few ounces to the square yard. Its indestructible nature enables it to resist decay under almost any conditions.'

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THE CHARACTERISTICS AND PROPERTIES OF THE MAIN TYPES OF ASBESTOS FIBRE. (Ref.2.)

The name 'ASBESTOS' is applied quite indiscriminately in Industry to several classes of fibrous minerals which fall into two main groups:-

I. SERPENTINE of which the principal member is 'CHRYSOTILE'- the silky white fibre of commerce.

2. AMPHIBOLE which includes 'CROCIDOLITE' (South African Blue) AMOSITE, TRENOLITE, ACTINOLITE, etc.

Of all minerals in these groups, two only have an important application; 'CRYSOTILE' and 'CROCIDOLITE'.

A third class is just coming into use called 'HORNBLENDE'.

CHRYSOTILE (White Asbestos) 90% of all asbestos used industrially, employed largely at the Rochdale factories. It occurs in veins in the mother rock 'SERPENTINE' and is widely distributed, although mostly procured from Canada and Rhodesia.

The fibres run perpendicular to the walls of the vein and are first separated from the rock by crushing. The resulting masses are resolved by further crushing into fibrous, elongated crystals, the

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length of which is normally equal to the whole depth of the vein of which they are part. The diameter of these crystalline fibres is fairly constant at about 1/500,000 of an inch i.e. 1/100 of the diameter of the cotton fibre.

They are white, silky and very flexible, and the length may be anything from 1/8th inch to 5 or 6 inches. Magnified by 1,000 diameters, fibres appear to be quite smooth and square in section. The Specific Gravity of the family ranges from 2.25 to 2.27.

In general, CHRYSOTILE is hydrated Magnesium Silicate -- $3MgO,2SiO2,2H2O$.-- but is seldom free from impurities. Other metals appear to replace the Magnesium to form uniform complex metallic silicates; these other metals are generally Alumina, Iron Calcium, Sodium, Potassium, and their total amount varies but little.

CROCIDOLITE (SOUTH AFRICAN BLUE)-employed in Leeds factory - is lavender Blue in colour and occurs in banded ironstone in similar manner to that in which Chrysotile occurs in Serpentine. Individual fibres are not so strong or so flexible. The length varies as the width of the vein -- from 1/8 of an inch to 2 inches. The diameter is twice that of the white fibre and the Specific Gravity varies from 2.6 to 3.2, It is a hydrated Ferrous and ferric silicate complicated in like manner by replacement of Iron by

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Sodium and Magnesium so that the ultimate Iron content is 35%. The chemical formula is $NaFe(SiO3)2,FeSiO3, H2O$.

HORNBLENDE is semifibrous and friable and not far removed from the Stearites. It is white but liable to discolouration and is used as a filtering medium. the formula is $Ca(MgFe)3(SiO3)4$.

The Magnesium is replaced by Iron partly.

TYPICAL ANALYSIS.

All High Grade.

TYPE	CANADIAN	CROCIDOLITE	HORNBLENDE
Carbonic Anhyd	---	---	0.87
Combined H20.	13.20	4.50	1.33
Silica	39.04	51.22	54.39
Alumina.	Trace	---	Trace
Ferric Oxid.	0.25	---	Trace
Ferrous Oxid.	2.10	34.08	7.10
Calcium Oxid.	0.51	0.03	12.04
Magnes. Oxid.	42.57	2.48	24.23
Sulphuric Anhyd.	0.10	---	---
Alkali and Loss.	0.23	7.17	0.04

All three classes have different properties, rendering them suitable for different commercial uses. All three resist boiling in alkaline solution. CHRYSOTILE suffers most when boiled in acids -- 60%

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60%/

in strong Hydrochloric Acid; the others lose only 5 to 10 and that is nearly all impurity.

Thus, for nearly all engineering uses, it is possible to prepare, by previously treating with acid, a cloth which will lose no more by further immersion.

The most important property of the fibres is their ability to maintain their fibrous state and physical strength when subjected to high temperature variations.

Asbestos is a crystalline formation and each class has a fairly uniform content of water of crystallisation. The higher that quantity, the better the physical strength and flexibility and so more desirable to spinner and weaver.
The CRYSOTILE family has 10% to 15% combined water, CROCIDOLITE - 4% - 10%., HORNBLENDE - 5% - 1.5%.

As Asbestos loses its combined water, (apart from ordinary absorbed water), it proceeds to an amorphous friable state. The temperature at which this occurs varies with the type in use and is of purely technical interest.

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THE PROCESS OF MANUFACTURE.

THE CRUDE MINERAL is invariably delivered in this country after it has been subjected to the process of crushing. By means of very delicate but very powerful machinery, the mother rock is crushed and separated from the asbestos without damaging its delicate fibres. On arrival in this country, the asbestos is first placed in SHAKING machines where, by gravity, it is separated from all rocky substances. There is a continual updraught passing through the machine and, as the fibres become freed from impurities, they are blown up and out into receptacles placed to receive them.

The long fibres are sent to the CARDING and CONDENSING departments; the short to the MILIBOARD and BOILERMAKING departments.

The long fibres come from the condensers in the form of a dense untwisted cord which coils itself into cans placed to receive it and thence passes to the SPINNING and DOUBLING departments where the process of twisting takes place.

The thread then goes to the WEAVING and BRAIDING departments where delicate machines make it into cloth, tape and yarns, etc., as required.

In the Leeds factory where crocidolite alone is used, the asbestos cloth is made very largely into mattresses for packing steam jackets of locomotives, steam pipes, etc., to prevent loss of heat.

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T H E D U S T

During certain of these processes, it is inevitable that a considerable amount of dust be formed. In the process of 'SHAKING', there is very little dust in the atmosphere as the machine is completely closed in. The asbestos fibre which is thus rendered light and feathery is next 'CARDED' and 'CONDENSED', i.e., the asbestos is exposed to the atmosphere and combed so as to make the fibres lie in more or less the same direction, after which it is compressed and drawn out to form solid cordlike strands. This stage in the preparation is quite one of the dustiest in the factory. Everything is covered with a fine bluish powder. (Crocidolite) The slightest movement raises clouds of this dust. Once carded and condensed, the product loses its dusty nature to a large extent.

In the Mattress-making department, however, much dust is raised, and most of my cases belong to this side of the factory. The mattresses emerge from the weaving process somewhat shapeless and lumpy and it is necessary to beat them into shape before completing the quilting process. This beating can only be done by hand. A male worker, invariably wearing a mask, rapidly performs this task and immediately leaves the room to allow the volumes of dust to settle. No one is supposed to enter the room until half an hour has elapsed. We shall see that this rule is not strictly obeyed.

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PRECAUTIONS TAKEN AGAINST THE DUST.

At the factory here, in Leeds, every suggestion put forward from time to time for the elimination of dust has been adopted. Large extraction fans are operating in every room; every possible machine is closed in and rendered dust-proof and, only recently, water sprinkling has been installed.

The dust extracted from the rooms is conducted to large rectangular towers and collected by filters.

Every worker is now provided with a respirator of an up-to-date type, and the workers are encouraged to wear them.

In the Mattress-beating rooms, each compartment being dustproof in itself, large extraction fans, helped by a powerful down-draught, are set in motion as soon as the 'brayer' (Beater) enters the room to beat the mattress spread out in readiness. These fans are operated until the dust has been cleared from the air. Unfortunately, the temptation to enter the room too soon is very great and is often too strong to resist, for these women are piece-workers and admit they frequently enter such a room full of dust, rather than their work be held up.

Again, in the matter of wearing masks, the human element is apt to defeat the ends of legislation and forethought, and usually on one of the following scores:- 1. The old hands who were there

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before the days of respirators, forced draughts, and Factory Acts, and whose lungs are consequently impaired, complain that the respirators "choke" them. They say they cannot wear the things, and they wont.

2. Many of the piece-workers find that they can work much more productively without masks, and so discard them.

3. The empty-headed type of young girl often will not wear a respirator because 'it makes her look silly'.

4. The force of example to beginners is almost entirely absent; only the few men employed are really keen on wearing the masks.

Welfare work is carried out on a more than generous scale by the management whose policy is to ensure an ample dietary at all times. A heavy three course meal is supplied daily for a few coppers; when an employee is ill, money, eggs, milk, chicken and wine are supplied freely and even Consultant's fees may, on occasion, be paid.

The workers generally are drawn from a healthy class, and mostly live in"back-to-back houses" which consist of one or two bedrooms upstairs and living room (Kitchen) with scullery down, the kitchen door opening directly on to the street - a type of house the building of which has now been abandoned.

The people believe that the asbestos 'grows' in the chest in the same way as it 'grows' on the

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hands, taking it as a matter of course that they will have chest trouble after some years work there.

Three pounds per week is the wage earned by the average girl and the expert hands earn considerably more. It is thus, from the wage earner's point of view, one of the most attractive unskilled occupations.

I may mention that there has not been a strike or lock-out for over fifty years.

"ASBESTOSIS."

The complacency of the workers is perhaps largely responsible for the indifference of Medicine to the insidious morbid processes set up by asbestos dust in the lungs. But to one in general practice near such a factory, it becomes evident, sooner or later, that this dust takes its toll in unmistakable fashion.

Quite early, (usually within five years) dyspnoea starts the vicious circle:- dyspnoea - inability to wear mask - increased dyspnoea.

After some time, a cough develops, dry, irritating, inevitable, and it has come to stay.

Perhaps a doctor is consulted. The chest presents no appreciable cause for alarm, no signs at the points of election, no adventitious sounds and little, if any, modification in breath sounds. There is no sputum. The heart is normal. The general appearance of the patient however, taken with the tiresome cough and the memory of what Silicosis means, probably results in a provisional diagnosis

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of early Tuberculosis, which may cause the patient to abandon work for a time.

If so, it avails little, for the cough defies treatment, and a day comes when the patient concludes that "she was just as well off at work" - and so goes back.

She may work for years with few interruptions, often returning to work after child-birth, but always subject to chest troubles - usually in the form of recurring attacks of acute bronchitis, sometimes definitely asthmatic.

Meantime - and she may last out for 20 to 26 years - she loses weight, becomes sallow-skinned, slightly cyanosed, rather hollow-eyed and generally 'scraggy'; her breathing becomes more and more laboured (Thoracic) and her cough more persistent; signs of manifest themselves in the chest but not the signs of Tuberculosis, nor is the Tubercle Bacillus found in the sputum; there may be friction sounds anywhere below the level of the axillae and often without pain; dulness at both bases becomes definite, with diminished vocal conduction; the apices, on the other hand, are found to be emphysematous; the cardiac dulness may be diminished for a time and later increased; and the breath sounds are diminished alike over the emphysematous upper lobes and the fibrotic lower lobes.

By this time, the patient is hard put to it

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it/

to carry on. Then a day comes when appetite fails without apparent cause, the tongue being clean, bowels normal, and no nausea or vomiting.

This is the signal for cessation of work.

The case may last, with care, for up to five years yet, with gradually increasing weakness, advancing fibrosis of the lungs, with embarrassed right heart, and multiple minute cavitations - mainly of the lower lobes.

Bed brings little relief, and medicine being only palliative, the case calls for constant attention. Sanatoria, beyond establishing by observation the non-tubercular nature of the complaint, can offer no tangible benefits.

So, we shall see (Case 1.) that, even at the age of 37 years, the asbestos worker may have completed the course.

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AETIOLOGY.

The factors in the production of all dusty diseases may be briefly tabulated:-

1. Length of time at work and exposure to dust.
2. Quantity of dust.
3. Quality of dust.
4. The size of the particles.

As regards the first two factors, little need be said as it is obvious that the longer one is exposed to the dust and the more there is of it, the greater the risk of the dust reaching the lungs.

Middleton (Ref.3.) states that a very dusty atmosphere is no criterion as to the damage-producing properties of the dust. Because of the fine size of the dangerous particles, he does not believe that respirators could stop all of them unless the filter be made so fime as to embarrass respiration.

The quality of the dust is of great importance.

Purdy (Ref.4.) in a review of 103 contributions on the subject of silicosis, found it to be the general opinion that, whilst other dusts might produce serious effects, silica was the most dangerous.

Landis (Ref.5.) states that any inorganic dust may produce lung disease varying from silica to that almost inocuous dust - cement.

'Hard rock miners, Sheffield knife grinders and stone cutters have a comparatively short period at work; potters, artificial flower makers, crystal grinders and diamond polishers also suffer to a

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great degree whereas graphite and Vienne sandstone do not produce the same injurious effects and wool appears to be comparatively inocuous (Ref.6.)

PATHOLOGY

The pathology of Asbestosis is, to a certain extent, on similar lines to the other dusty diseases.

A large quantity of the dust is caught in the nose and pharynx and so removed by expectoration and swallowing.

Lower down the respiratory tract, the particles are caught on the muccous-bathed walls of the trachea and bronchi and swept back to the pharynx by the cilia. Many particles, however, - chiefly the smaller ones - get right down to the bronchioles and alveoli and the real pathology of the disease begins.

The fine particles of dust set up a catarrhal process with the proliferation of certain cells. Long has a controversy raged over the origin of these cells, conveniently called 'Dust' cells.

Mavrogordato (Ref.7.) believes that the 'Dust' cells arise from the endothelium lining the lymphatis and capillary vessels and he has, experimentally, traced them from the incorporation of dust particles to the formation of fibrous tissue. He thinks that, as the relationship between the endothelial cells and alveolar epithelium is very intimate - in some places even interrupting it - the arrangement favours the former.

If the dust cells do become fibrous tissue,

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tissue,/
this certainly excludes the latter.

His experiments showed that the polymorphonuclear leucocytes failed to take up silica and dust.

In his experimental intravenous injection of fine dust, the particles were taken up by the endothelial cells of the blood vessels.

Riddell (Ref.8.) in his report of an autopsy on a quarryman states that endothelial cells, containing pigment, were found in the alveoli, interalveolar tissue, pleura and liver.

Permar (Ref.9.) injected intra-tracheally into rabbits showing a mild anthracosis, a saline suspension of carmine. The particles were phagocyted rapidly and became intracellular in twenty four hours by large mononuclear cells which had arisen from the capillary endothelium. Some were in situ; others could be traced from the capillary walls to the alveolar spaces. Some remained there; others remigrated and could be traced to the terminal lymphatics near the alveolar ducts and others were traced passing slowly hilumwards where the first particles arrived in twenty four hours. He quotes Sewell (Ref.10.) as believing the dust cell to be derived from the endothelium lining the blood and lymph vessels.

Willis (Ref.11.) states that some authors hold that the dust particles pierce or pass between the cells. He himself believes all dust to be intracellular.

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Both in Dr Cooke's case and my own, many of the fragments are extracellular and much too large to have been phagocyted. Some particles - the larger ones - could not even reach the alveoli but blocked the bronchioles, as will be seen by the fact that the epithelium lining some of the alveoli has reverted to its embryonic, cubical form; in other alveoli, caseation has set in.

The next pathological process is the entrance of the dust cell into the lymphatic circulation.

Gardner (Ref.12.) found the cells move to the lymphoid tissue at the distal end of the alveolar duct. There, the tissue hypertrophies, and the cells next move to the lymph tissue at the junction of the bronchioles and bronchi and so to the tracheo-bronchial nodes. If the stream is blocked, fibrosis occurs and the dust is no longer removed.

Mavrogordato (Ref.7.) states that silica protects the cells from autolysis and lymph digestion - thus, they are able to accumulate and block the lymphatics. With other dusts, like coal, the cells are destroyed and so do not cause a blockage. He believes that the silica is slightly soluble in the alkaline body juices and so forms alkaline silicates which protect the cells and preserve them.

Fibrosis is the essential pathological process and on it and the lymph blockage, depend the x-ray appearances.

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Mavrogordato (Ref.7.) and many others believe that the dust cell becomes a fibroblast and the dust particles are left extracellular. This would account for the fibrosis beginning along the lymphatics and extending along arteries, veins and bronchi.

With the blockage of the lymphatics, the fibrosis spreads to the interstitial lung tissue where the lymph vessels run. The blockage sets a backflow towards the pleural lymphatics and so gives rise to pleurisy and adhesions.

In Riddell's case (Ref.8.), the pleura was 1 - 1.5 mm. thick, the interlobular fissures adherent and also the diaphragmatic pleurae.

Both in Dr Cooke's case and in my own, these changes have all been found. There are, however, some special features in these cases which seem to be peculiar to workers in asbestos as compared with other dusty occupations.

One is first struck by the extra-ordinary size of some of the particles. (See Figs.2,4,8,15.) Many have a distinctly fibrous structure and are undoubtedly composed of asbestos.

In addition, there are many small particles which are amorphous and consist partly of carbon and partly of material which is probably asbestos dust, but, for this, there is no micro-chemical test and a fibrous structure is not apparent owing to their small size and irregularity of outline.

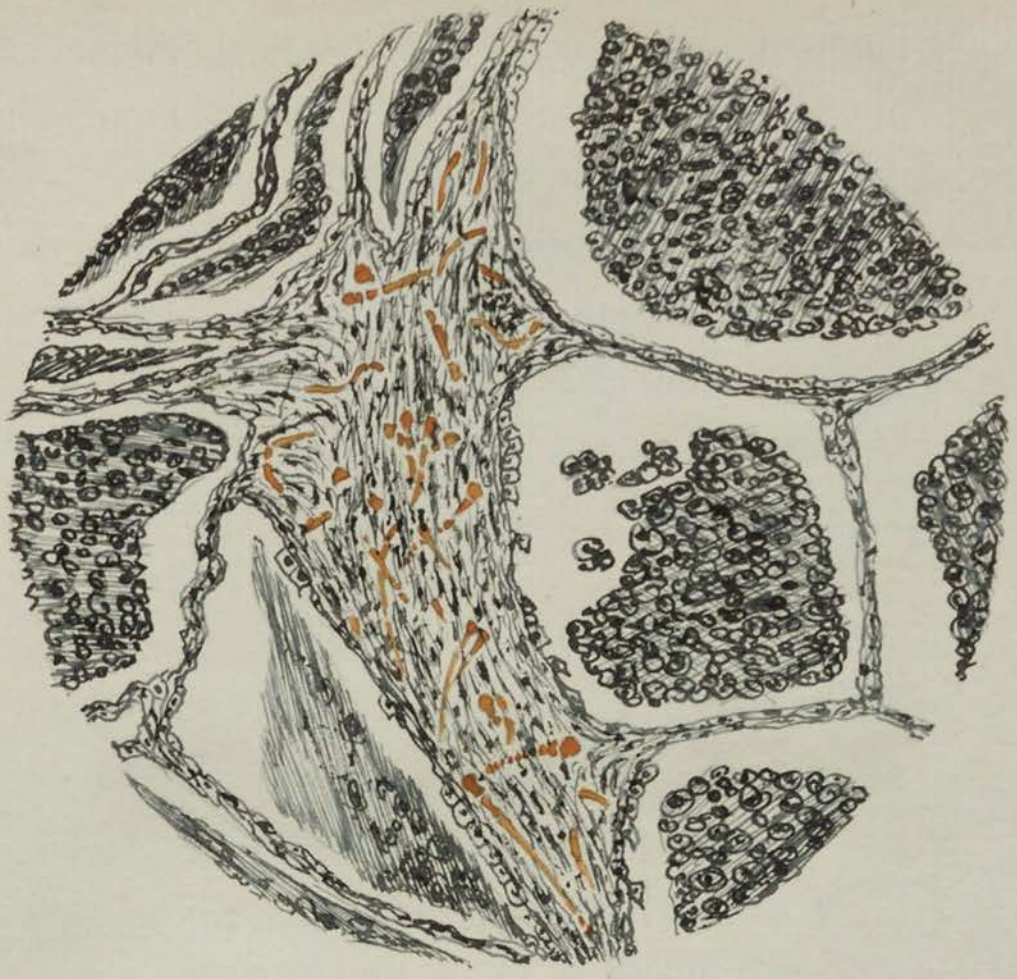
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in the third place, there are present peculiar bodies, mostly arranged in clusters, which have the appearance of some kind of mould. It is impossible without making a culture, to say whether or not they are living organisms but they appear to resemble the type Aspergillus. There are however some differences which I will discuss later. Professor Tissot of the Natural History Museum of Paris last year published the results of four years investigation into the constitution of animal and vegetable organisms along with a very large number of photographs of moulds (Ref.14.) but none had exactly the appearance of these structures and all were much larger.

Dr Cooke submitted his sections to many branches of Science including Mycologists, Botanists, Zoologists, Bacteriologists and Comparative Pathologists and the opinions expressed varied greatly. I have been fortunate in gaining access to the correspondence. I quote extracts of their opinions along with some which I have myself obtained.

Chapman of Duke Street, London states that the particles do not look like a mould; they more closely resemble some diatomaceous or other form. He found one organism which had all the appearance of a diatom. He particularly noticed very numerous transverse markings on what, if it had been a mould, would have been a Hypha or Mycelium. This was unusual.

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Drawing from a section of lung stained with Haematoxylin and Eosin (Semi-diagramatic) showing consolidation of lung due to Broncho-pneumonia, superimposed on a chronic Interstitial Pneumonia.

Note :-

1. Cubical epithelium lining some of the alveoli.
2. Proliferation of fibrous tissue associated with
3. Many peculiarly-shaped bodies whose golden-brown colour has remained unaltered on staining.
4. Amorphous anthracotic particles, widely distributed.

N.B. In sections treated with Hydrochloric Acid and Potassium Ferrocyanide, the golden-brown bodies(3) appear a deep blue.

(Own case (1))

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Hewlett of the Dreadnought Hospital, Greenwich thinks definately that these bodies are fungoid - probably Aspergillus.

Hare, at present working on Mycology at Cambridge, does not think they are fungoid.

Ledingham of the Lister Institute, Chelsea, thought at first they were diatoms or splinters of diatoms. He found these abundant in emulsions of raw asbestos marked out like hexagonal boxes. Lots of bits seen with discoidal markings exactly resembled the tissue ones. After consulting Miss Robertson, the Protozoologist, his opinion was modified. She thought that, undoubtedly, the structures in the raw dust and in the lung were radiolarium spicules.

Murray of the I.C.R. Fund, London thought these bodies were just altered asbestos. The brown deposit might be altered pigment or hydrated ferric oxide from decomposition of the iron silicate in the asbestos. He could not see double refraction such as fresh asbestos gives - presumably due to the decomposition of the surface layer.

Scott of the Zoological Society, London, would not express an opinion without culture but thought there was commencing fructification suggestive of Aspergillus.

Stokes, Eyre, Nicholson, and others of Guy's, were at a loss to explain the bodies. They unanimously decided that they were not portions of an Aspergillus. It was suggested that they were dead

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dead/

portions of vegetable tissue but without enthusiasm or confidence.

Castellani of Harley Street, says he is unable to classify the fungus without cultivation. He thinks it might possibly be a species of Penicilium altho' fructifications are absent. Penicilium are not rarely found as a secondary invader to Tuberculosis.

Butler of the Imperial Bureau of Mycology thought that none of the true fungi known to him were likely to develop structures like those found in the tissues. Monilia (as understood by Castellani, etc.) may be excluded and also the Aspergillus and its allies. He states that if the structures are organisms at all, the most likely direction in which to look was the Actinomycetes. The points against being a living organism are :-

The difference in size between the maximum and minimum diameters, the 'double headed' clubs, and the tendency to break down to granulations, leaving nothing behind in some cases. Some comma-like shapes are drawn to a fine point or slightly swollen.

The constant repetition of some shapes suggests 'casts' of cavities provided they are not living organisms.

Ramsbottom of the British Museum of Natural History is quite sure they are not fungi. He says a fungal Hypha of this type under a reasonably high power would show a lumen; these do not and the walls have a corroded appearance. One of his collegues

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collegues/
suggested that crystallisation had taken place by the slides being allowed to dry but he could find no trace of any way in which the crystals could appear.

Cooke and Hill hold the view that it is a Hyphomycete analogous to that found by Scott in Batrachians, or that it belonged to the Tuberculariaciae, a family of hyphomycetes described by Ehrenberg in 1818.

Sir Thomas Oliver refuses to believe, in the absence of cultural evidence, that these bodies have ever been living organisms. He considers they are probably particles of asbestos undergoing some modification, e.g. colloidal change, in the tissues.

I have put this suggestion to the chief chemist (J.F.Ward) of Crooke's Laboratories, and he, whilst reluctant to believe that asbestos is capable of being modified by any chemical substance, admits that it might, under certain conditions such as constant bathing in the blood or serum, be gradually 'peptised'. If such could happen, and if some highly resistant substance such as Tourmaline were present in asbestos fibre, this material would probably resist the 'peptic' action. Tourmaline which is black, was found to be the resistant element in China Clay.

Naturally, in the presence of so much diversity of opinion, I have great difficulty in coming to a definite decision.

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In the opinions quoted, in which no particular view preponderates, nothing of a final nature is to be found. In favour of the particles being organic, are the following features:-

1. The appearance of segmentation.
2. "Fructating Heads".
3. Spore-like structures around the heads.
4. Their occurence in nests or clumps in the alveoli.

On the other hand, the points in favour of these structures being inorganic are :-

1. The great variation in size between the maximum and minimum diameters, particularly in Dr Cooke's case.
2. The absence of a lumen.
3. Their peculiar staining properties - resistance to all the usual organic stains.
4. The positive Prussian Blue Reaction proving their high iron content.
5. The dumbell or double-headed formation.

There are even certain points of difference between their appearance in Dr Cooke's case and in my own.

The structures in my case are, on the whole, smaller, more equal in size, have more rounded heads and less tendency to ' fructations and spores'; but they both have the same staining and chemical reactions.

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In the absence of cultures and in view of the findings generally, I cannot help favouring the view that these structures will yet be proved to be a highly resistant substance present in the spicules which are seen amongst the asbestos fibre, modified by long immersion in the body juices.

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FIG 1.

'Asbestos Fibre and Dust.' x 150.



FIG 2.

Asbestos particles in fibrotic area of lung.

x 150.

(Dr Cooke's Case.)

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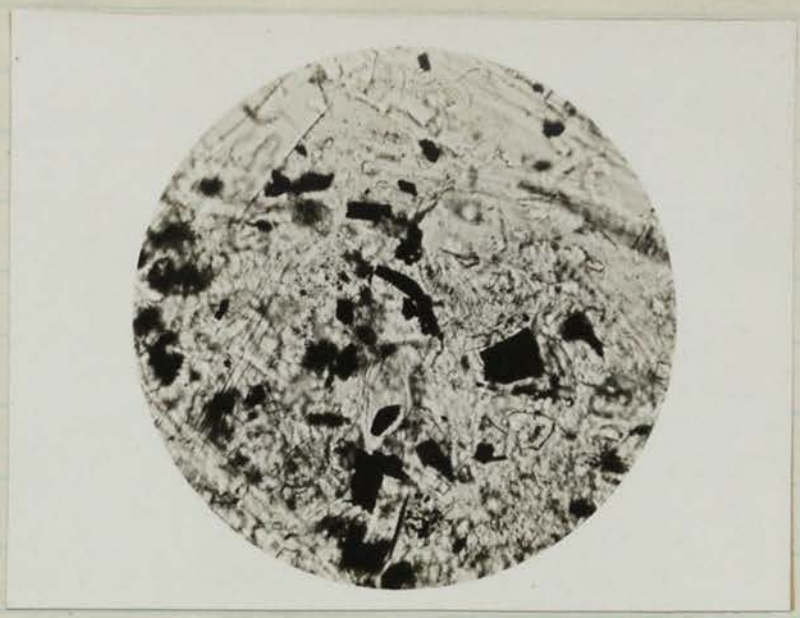


FIG 3.

Asbestos Dust. x 150.



FIG 4.

Iron containing fragments of asbestos fibre in fibrotic area of lung. x 150.

(Dr Cooke's Case.)

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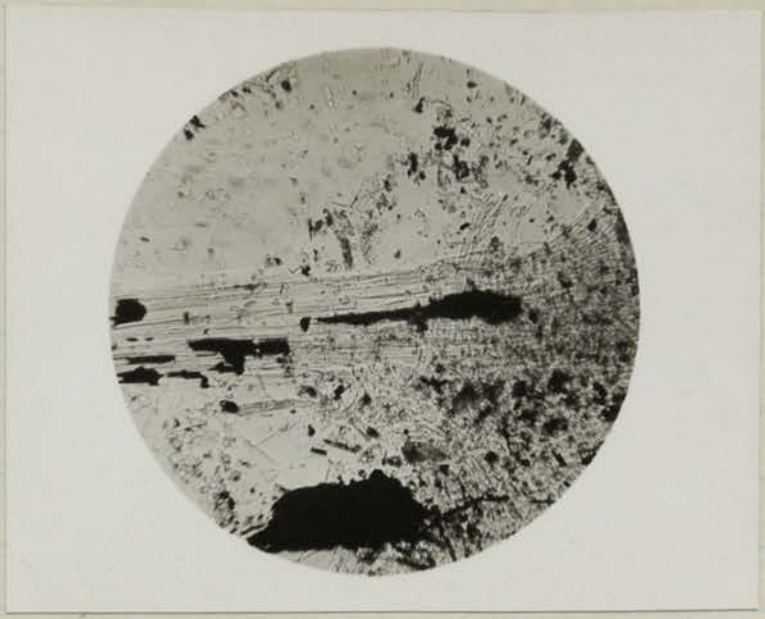


FIG 5.

'Asbestos Fibre.' x 150.

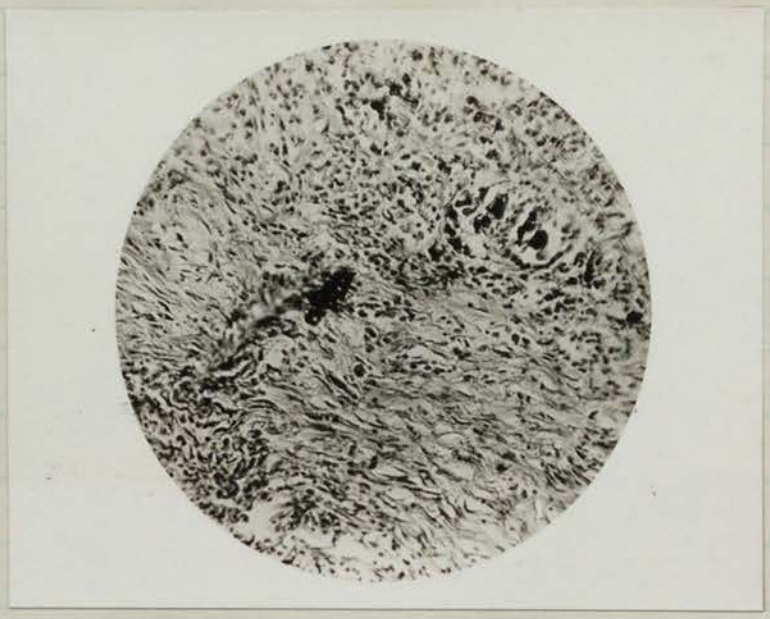


FIG 6.

Curiously shaped asbestos particles in fibrotic area of lung. x 150.

(Dr Cooke's Case.)

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FIG 7.

Asbestos Fibre showing large angular iron-containing particles and granular 'dust'. x 150.

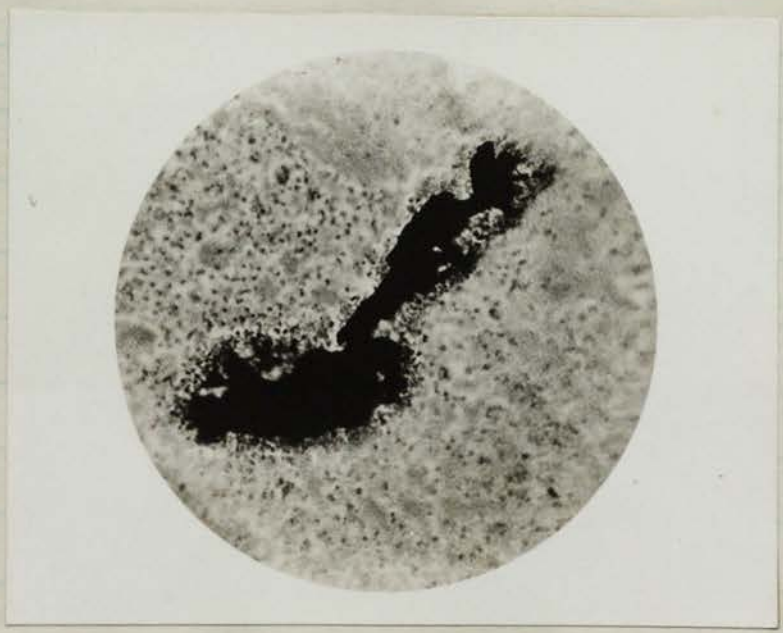


FIG 8.

Asbestos particle 360 microns in length in necrotic area of lung. x 150.

(Dr Cooke's case.)

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FIG 9.

Unstained section of lung showing curious structures resembling fungi. Note the great variation in size.

x 150.

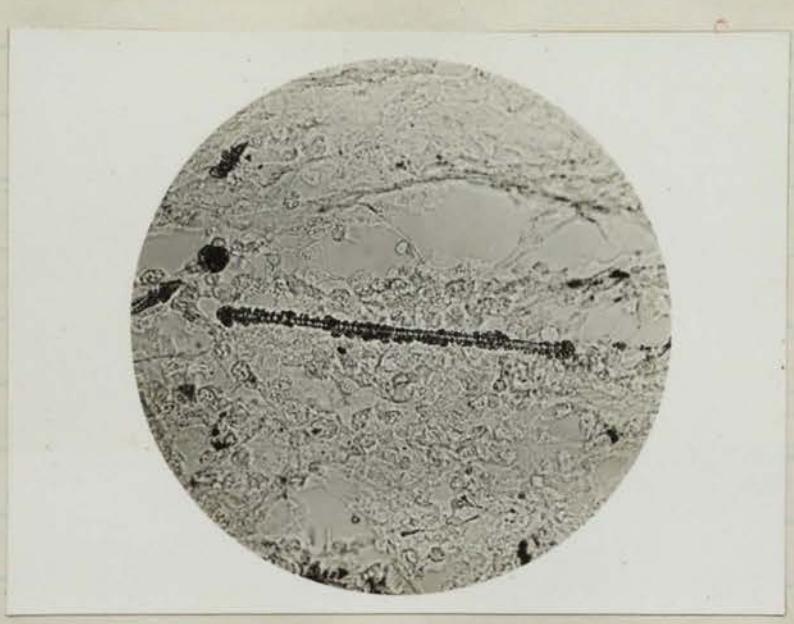


FIG 10.

The same - showing a 'budding' appearance in the ends and shaft. x 150.

(Dr Cooke's Case.)

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FIG 11.

One of the bodies resembling a double-headed club.

x 150.



FIG 12.

Another micro-photograph showing great variation in size of these bodies. x 150.

(Dr Cooke's Case.)

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FIG 13. x by 400.

Stained section showing the relation of these bodies to the surrounding tissues. The photograph above shows the bodies lying in alveoli, and they



give the appearance of having a lumen.

In the photograph below, one of the bodies is lying in the stroma.

x by 400.

(Dr Cooke's Case.)

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FIG 14.

High power view of the structure seen in an unstained section.



High power view of the structures seen in FIG 13.

x by 1,000.

(Dr Cooke's Case.)

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X-RAY APPEARANCES.

The X-ray appearances are quite distinct from either Silicosis or Tuberculosis. In all but two of the plates which show pathological change, the fibrosis is below the level of the fourth rib anteriorly and the sixth rib posteriorly. Above that level, the lungs give quite a normal shadow.

Below, there is fine mottling and diminished radiolucency with flattening and irregular outline of the diaphragm - with or without definite adhesions. Pancoast and Pendergast (Ref.13.) found that in Pneumokoniosis due to Silica, the first change was in the root shadows which became enlarged and dense. This was followed by generalised mottling throughout the lungs and finally, massive fibrosis occurred in scattered patches - not confined to the base. The outlines of the diaphragm are usually clear. (See X-ray photographs of Silicosis.)

In Tuberculosis on the other hand, the apices are generally affected - seldom the bases. (See X-ray photographs of Tuberculosis).

In Asbestosis, the right lung is, on the whole, more affected than the left one. This may be explained by the greater accessibility of the right bronchus to inhaled particles influenced by the force of gravity. The grosser the dust in the case of a mineral, the greater would be the influence of gravity in determining its deposition in the lung. The outlines of the diaphragm tend to be obscured, flattened and irregular, and in some cases

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Mr. Hall. A CASE OF SILICOSIS.

This man worked as a stone-mason for thirty years; he has not worked for twenty five years.

Note that in this case, there is a generalised mottling - not confined to the base as appears to be typical of the Asbestos worker.

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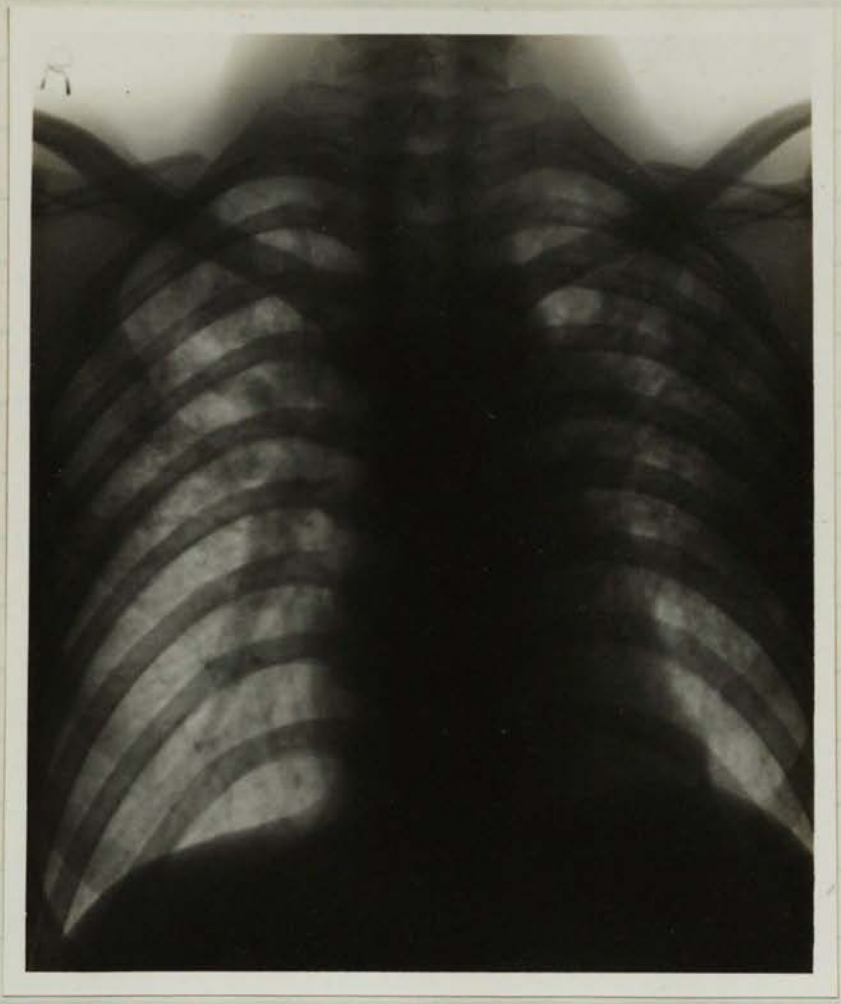


Mr. Hall. A BRASS WORKER. (SIDEROSIS.)

In this film, there is a coarse mottling throughout both lungs - more or less generalised.

Compare with the films of the Asbestos workers.

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Mr. Briggs. A CASE OF ACUTE TUBERCULOSIS.

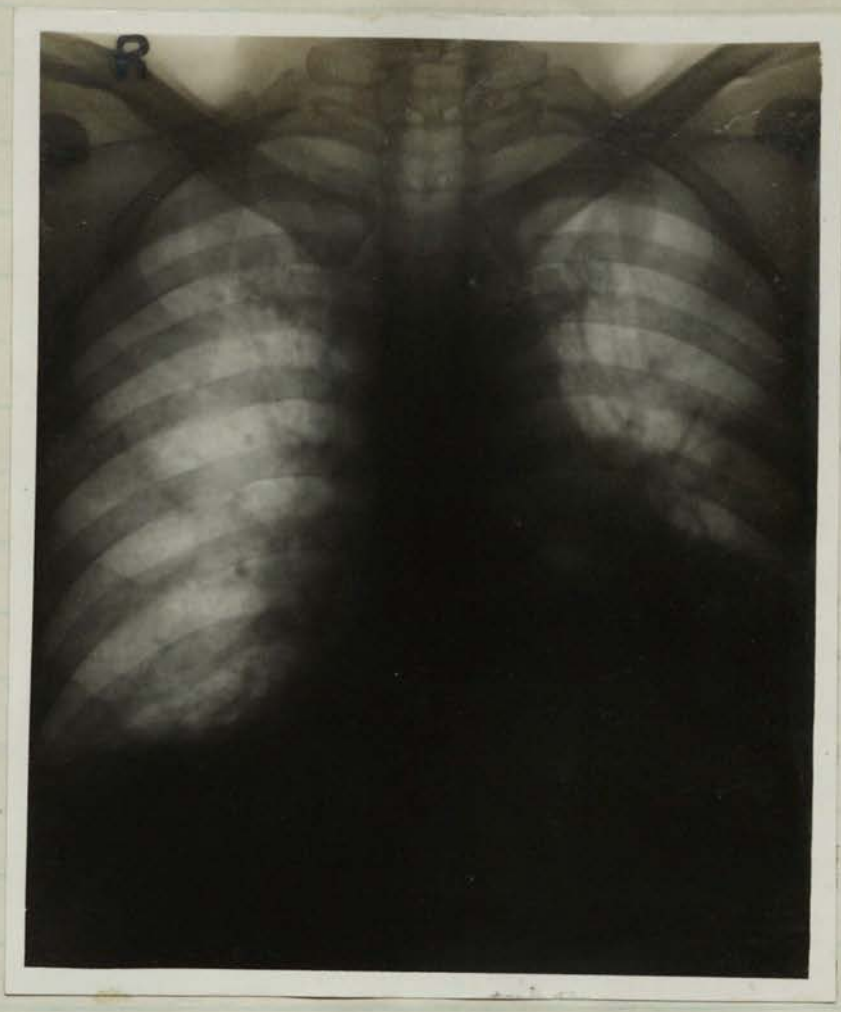
The disease is confined to the upper parts of the lungs, chiefly the left: There are some adhesions to the left side of the diaphragm, but the outline of the diaphragm on both sides is perfectly clear. (Distinction from an advanced case of Asbestosis.)



Mrs. Kirkby. A CASE OF OLD TUBERCULOSIS of the RIGHT APEX.

There is marked fibrosis of the right apex together with some peribronchial fibrosis at the right base.

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ADVANCED CASE OF ASBESTOSIS. (Case 3.)

Showing relative clearness of the upper lobes as compared to the bases which are densely infiltrated. The apices are, in fact, normal in this case. Yet, the outline of the diaphragm is completely obscured by the disease. Further radiographs will be found accompanying the cases recorded later.

cases/
adhesions are seen.

CLINICAL FEATURES.

As there are distinctive features in the Histology and in the X-ray findings, so too, are there some special facts to be observed in the symptoms and signs of asbestosis.

One of the most striking features of the disease is DYSPNOEA - out of all proportion to the physical signs present. It comes on insidiously about five years after starting work and gets progressively worse if the worker continues at his employment. At first, the breathlessness is only noticed on exertion but, as the fibrosis advances, it becomes worse until it is present, to some extent at least, all the time. In Cases 2 and 3, the dyspnoea is so marked that, during the summer months, they consider themselves extremely lucky to be able to walk as far as a public park, situated not more than 400 yards away. In winter, they are forced to bed for days at a time. Cases 6,7,8,9,and 10 are all suffering from a fairly advanced stage of the disease and, in their case, the dyspnoea is troublesome on moderate exertion. Whilst sitting still, they feel quite fit and well but the climbing of a flight of stairs is sufficient to bring on a fairly severe attack of dyspnoea.
In Cases 12,13,and 15, who are comparatively new hands and free from other symptoms, breathlessness

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breathlessness/
is entirely absent, and the only sign in all of these is the slight mottling at the right base in Case 12.

COUGH is one of the most distressing features of the condition. Out of the fifteen cases which I have submitted, twelve of them continually show this sympton and attend the surgery regularly during most of the year. Of the remaining three (Cases Nos. 12,13, and 15.), one just came to me for examination and does not belong to my Panel, and the other two have only worked at the factory for a period of three years. In the earlier stages of Asbestosis, a dry, tickling morning cough appears which later becomes persistant all though the day, the lack of expectoration being a peculiarity in even the most advanced cases. Only one patient (Case 6.) has a very loose cough with free expectoration, and one other occasionally has a moderate amount of sputum. The sputum, when present, is of a tenacious and muco-purulent character.

EMACIATION is present in all of the established cases, and increases as the disease progresses.

In some (as in Cases 2 and 6.), the wasting is very marked; their eyes are sunken, their cheeks hollow, and there is little or no flesh covering their bones. Case i., before her death, showed the emaciation to an extreme degree. At death, she was a mass of bed-sores although she had been carefully nursed on a water bed in hospital for six months previously.

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The moderately advanced cases are steadily losing weight in spite of good food, tonics, Cod liver Oil, etc.

PLEURISY is a common feature also and it is accompanied by little or no pain. On examining the chest, one hears coarse friction sounds but the patient seldom confesses to pain accompanying.

I have never succeeded in finding the Tubercle Bacillus in the sputum of any case - even on successive examinations nor have I had a positive Von Pirquet Reaction. Case 1. who died from what was certified to be a Tuberculous Broncho-Pneumonia, had had her sputum examined many times but the Tubercle Bacillus was never seen. The section of her lung shows none. It would almost seem that the fibrosis set up by the asbestos protects against Pulmonary Tuberculosis. Considered mechanically, the early disablement of the lower lobes by fibrosis and diaphragmatic pleurisy, necessitating vicarious over-activity of the apical respiration, can be only salutary so far as Tuberculosis at the sites of election is concerned.

Landis (Ref.5.) states that, in potters and coal miners, Tuberculosis is usually non-toxic and easily controlled by rest. He attributes this to the fibrosis limiting the disease and so rendering the lungs less susceptible. Tuberculosis develops late in potters.

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In acute silicoting diseases, the same changes take place in two to eight years which take twenty to thirty years in potters. In rapied cases, the lungs are acutely inflamed and a fertile field for the Tubercle Bacillus. From a study of the clinical features of the cases presented, I think one might almost agree that Asbestosis, too, protects or controls the Tubercle Bacillus.

It is worth noting the entire absence of night sweats in all my cases.

The PHYSICAL SIGNS in Asbestosis are typical and vary only in degree.

On inspection, one notices, first, the tendency towards thoracic rather than abdominal breathing. The skin shows some slight bronzing and the lips, very often, a tinge of cyanosis.

Palpation may show nothing or the Vocal Fremitus may be diminished. Expansion at the bases is usually considerably below normal.

On percussion, broadly speaking, the apices are resonant and the bases dull. The hyper-resonance at the apices is due to a 'compensatory' emphysema. The cardiac dulness is generally diminished for the same reason, but may be increased if the fibrosis is marked, because of the contraction of the fibrous tissue dragging the lung substance towards the hilum. Tidal percussion is invariably diminished even at a relatively early stage of the disease.

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On auscultation, the breathing is faint vesicular. In the lower part of the chest, this is due to the fibrosis: in the upper part, the emphysema is to blame. The accompaniments vary; there may be none—in the early stages, there are none unless perhaps a faint pleural rub—or there may be every variety of adventitious sound.

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TREATMENT.

The treatment of the condition, like all other dusty diseases, lies in energetic measures for the prevention of the dust. At the local works, every likely suggestion for the prevention of the inhalation of dust has been adopted. I cannot certify to this being done in other works in the country. I attempted to gain admission to a factory in Bradford but was informed that visitors were not allowed. Mr. Roberts, the manager of the Leeds works, informs me that, abroad, where the asbestos is mined, no precautions are taken to allay the dust and the conditions under which the men work are appalling.

I have already mentioned the matter of the use of respirators. I would suggest that prospective workers should undergo a medical examination and, if accepted, should be compelled to wear respirators all the time.

The laying of the dust by sprinkling with water has been done in many dusty trades and has recently been adopted in Leeds.

The back-to-back houses are, no doubt, detrimental to the general health of the workers but this cannot be remedied for many years to come. Up to the present, I have noticed that there is no eagerness amongst these workers to exchange their obsolete homes for the modern housing estates, for a woman who goes out to work all day cannot look after a six-apartment dwelling.

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As regards drugs, I am convinced that nothing will stay the progress of the disease.

Potassium Iodide, which is always recommended in Silicosis, certainly gives no relief in the asthmatic cases and I have not felt justified in persevering in this expensive line of treatment.

As in Tuberculosis, one gives Cod Liver Oil preparations, Hypophosphites, etc. in the hope of counteracting the wasting process, always with the risk of upsetting the digestive system.

In the same way, one tries 'pulmonary antiseptics' and this has at least proved more popular. Combining Creosote and Sodium Formate with sedative expectorants, I have been able to afford marked relief to the cough, insomnia and even anorexia. These patients return again and again for the following prescription :-

Recipe.

Creasoti pur.	
Sodii Formatis āā	℥i.
Codein. pur.	gr.ii.
Terpin.Hydrat.	m.xvi.
Syr.Pruni Virg.	℥iv
Aq.Chloroformi ad	℥viii.

Misce.

Sig. ℥iv.4tis horis ex.aq.

This mixture is remarkably well tolerated and I generally increase the above doses by one half for prolonged administration.

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C A S E No. 1.

May Speke. Died in hospital, aged 37 years. Single.

Occupation. Mattress maker. She was engaged at this work for over twenty years.

History An autopsy was held which I was permitted to attend. Notes from her panel record card.

9/8/23. "Doubtful left base" Certified unfit for work.

1/7/24. Certified fit again.

8/10/24. Unfit again.

3/2/25. Fit again.

11/11/24. Report from The Tuberculosis Dispensary "Chronic Fibrosis; Pulmonary Tuberculosis. Supra-scapular dulness and fibrosis with post-tussis crepitations. Occupation may be a factor in causation but not a case for compensation. Not active".

3/2/25. Certified fit for work. Worked until

7/7/25. Certified unfit. (Finally).

28/8/25. "Breaking down apices. Moist crepitations heard throughout lungs with friction at both bases".

31/8/25. Admitted to St. James' Poor Law Hospital.

Notes from the Hospital

Thoracic System. Breathing - vesicular on the left, Bronchial at the right apex. Pain at lower end of Sternum. Cough bad - sputum very little.

Digestive System. Appetite poor - bowels very costive.

Thoracic Signs. Shape of chest - Flattened on the right side. Movement poor. On auscultation, the breathing at the left upper lobe is vesicular but

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harsh. On the right side, it is bronchial, and in places, has an amphoric quality. Temperature 99.6. Respirations 28 per minute. Pulse rate 100.

1/9/25. Her trouble began with a cough three years ago, when she saw a Doctor, and was treated for pleurisy by painting and strapping. She had been in a Tuberculosis Sanatorium for some time in the early part of 1923. She is losing weight.

26/10/25. The right side of the chest lags behind the left side. The right apex has poor movement. Infraclavicularly there are very loud harsh breath sounds with long expiratory phase accompanied by small sibilant rhonchi. The Vocal Resonance is increased. No pectoriloquy is exhibited. There are small crepitations at both bases into which there is only a poor air entry.

31/12/26. This patient has been bed-fast for the last two months, and has also been complaining of pain between the shoulders at intervals. She has been losing weight gradually.

7/3/27. She has been gradually getting worse. Died at 9-10 a.m.

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C A S E 1.

Post Mortem Appearances.

Macroscopic Appearances.

Right Lung. The pleura was markedly thickened and completely adherent all over - to the parietal pleura, to the pericardium, and between all the lobes. The lung substance was a deep blue in colour and weighed 1 lb.2 oz. The glands at the hilum were enlarged and black - with thickened capsule.

On cutting into the lung, the knife almost appeared to grate. The cut surfaces showed marked fibrous bands running in from the pleura and subdividing until the whole appeared to be more like a section of spleen rather than lung tissue.

The lowest lobe showed consolidation due to broncho-pneumonia. The tissue above showed intense fibrosis together with some tiny pinhead cavities.

The bronchi were greatly thickened and gaping.

The apex was fibrosed but to a less extent than the rest of the lung. It showed no cavity formation or scarring.

Left Lung. There was marked thickening of the pleura which was adherent all round the apex and posteriorly as far down as the termination of the Inferior Vena Cava. There were two thick bands attaching it to the parietal pleura laterally at the level of the fifth rib and the medial part of the diaphragmatic surface was adherent. The cut surface was gritty but not quite so fibrosed and

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hard as the right. The glands at the root were enlarged, hard and pigmented.

No cavitation or scarring of the apex was seen.

Microscopic Appearances

The section taken shows changes in the lung due both to the Broncho-Pneumonia and to the Fibrosis.

The Broncho-Pneumonia showed the usual changes which one would expect to find in this condition with an Interstitial Pneumonia superadded.

Pneumococci but no Tubercle Bacilli were found.

The section also showed some extremely interesting features the like of which, as far as I know have only once before been described - by Dr. Cooke of Wigan at the Liverpool Conference of the Royal Microscopic Society in March, 1927, and the appearances both in Dr Cooke's case and my own are shewn in the microscopic photographs which follow.

The arteries are, in many cases thrombosed and thickened; the bronchial walls are thickened and almost occluded. Many of the Alveolar epithlial cells have reverted to the cubical embryonic form.

Scattered throughout the whole of the section, but more prominent in the fibrotic areas, are numerous black particles of mineral matter.

Some of them showed a distinct fibrous structure and are undoubtedly composed of asbestos.

The others are amorphous and consist partly of carbon and partly of material, which is

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probably asbestos dust, but for this there is no micro-chemical test and a fibrous structure is not apparent on account of their small size and irregularity of outline.

There are also present some peculiar bodies whose nature - animal, vegetable or mineral - it is difficult to determine. They are golden brown in colour and, in their structure, resemble a fungus of the type Aspergillus. They do not stain with any of the usual stains; Haematoxylin, Eosin and the Zeil Neelson stain are alike fruitless. The Prussian Blue Reaction is positive as also is the confirmatory test of Nitro-Hydrochloric Acid and Sodium Thiocyanate. They vary greatly in size and in the size of their constituent segments; some of the bodies are long and narrow with bulbous heads; others are small 'comma' shaped masses. They ~~mainly lie in the alveoli and bronchioles but some~~ can be seen in the interalveolar tissues.

The section of gland taken from the hilum shows an intense amount of anthracosis and some small golden brown particles which rather resemble broken down blood corpuscles but which give the Prussian Blue Reaction and confirmatory tests.

Unfortunately, no attempt was made to grow cultures at the time of the autopsy and so the problem of the origin, nature and significance of these strange structures remains, subject to discussion of their morphological appearances only.

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FIG 15. x by 550.

Micro-photograph showing peculiar bodies lying - some in an alveolus, some in the tissues. Notice the segmentation of the structures.



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FIG 16.

Unstained section showing marked appearance of segmentation together with small granules which suggest spores. x by 1,000.

(Own case.)

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FIG 17. x by 100.

Micro-photograph of section of Gland from the hilum showing intense pigmentation along with smaller but similar bodies to those in Fig 16.



FIG 18.

Asbestos particles, granules and the peculiar structures seen lying in the fibrous stroma.

(Own Case.) x by 350.

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CASE No.2.

Harriet Slater. Aged 48 years. Married.

Occupation. Mattress Maker ever since leaving school at the age of 14 years.

Complaint. Loss of weight, cough, and general debility.

Duration of present illness. Two years.

History. Her troubles began insidiously some ten years ago but she only came under my care in August, 1925 when she complained of cough and loss in weight. I have no notes on her chest condition then, but her weight was 6st.10lbs. and there was Albuminuria. In June, 1926, she was notified as suffering from Phthisis. At that time, the Left Lung was resonant to percussion at the apex gradually becoming dull towards the base. There were numerous crepitations all over the lung, especially marked at the lower apex. The respiratory murmur was harsh here with prolonged expiration. The vocal resonance was diminished except at the lower apex where it was slightly increased.

The Right Lung was hyper-resonant at the apex but the base was even duller than the left one.

At the apex, the breath sounds were harsh with prolonged expiration and numerous clicking crepitations. She complained of a hacking cough with

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with/
very little sputum. On examination, no Tuoercle Bacilli were found. Her appetite was very poor, her tongue dirty, and the bowels stubborn.

Family History. Father died, aged 55 years, from Apoplexy.
Mother died, aged 62 years, from Bronchial Pneumonia.
She worked at the Asbestos Factory for some years before her death.
Children. Daughter aged 27 years. Also an Asbestos worker. (See Case No. 3.)
Two Sons aged 15 years and 12 years. Alive and well.

No Miscarriages.

State on Examination.

The patient is an intelligent, clean woman. Height 5ft. 3ins. Weight 6st. 1 lb. dressed with overcoat. She is extremely emaciated and cyanosed, but is of a cheerful disposition.

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Respiratory System.

Subjective Phenomena. She is very greatly troubled with a harsh dry cough - worse on going to bed and getting up - and extreme dyspnoea on exertion. Pains in the chest are also common - coming on acutely and lasting a few days at a time.

The breathing is a conscious effort - thoracic in type. Rate 24 per minute.

The sputum is slight in amount and, when present, is mucopurulent. It has been examined on three occasions for the Tubercle Bacillus but has always been negative.

Thorax.

Inspection. The chest is poorly clad, barrel-shaped, with sunken apices. There is indrawing of the interspaces between the fifth and seventh ribs on the left side.

Expansion is poor - 23ins.--23½ins. at the nipple line.

Palpation. The expansion at the apices and bases is poor. The apex beat is displaced outwards half an inch beyond the nipple line. The Vocal Fremitus is diminished generally.

Percussion. There is resonance at both apices and infraclavicularly but posteriorly, there is dulness which increases towards the base.

Auscultation. The left apex shews coarse breath sounds with prolonged expiration. At the root of

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of/

the lung, the respiratory murmur approaches the normal and, at the base, the breath sounds are faint - accompanied by moist tinkling sounds which are heard right out to the left lower apex. The right apex and root shew coarse breath sounds - with prolonged expiration. At the apex, the breathing is amphoric accompanied by clicking crepitations. At the base, the Respiratory murmur is faint,with a few faint crepitations and friction sounds. Here and there,throughout both lungs can be heard rhonchi and whistling rales.

Circulatory System.

Subjective Phenomena. The patient complains of pain under the sternum - 'like a big lump pressing' Dyspnoea and cough are also very troublesome.

Pulse. Arterial wall readily palpable. Rate at rest 84. Rhythm regular. Amplitude fair and wave well sustained..

Blood Pressure by sphygmomanometer - Systolic 124.

Diastolic 95.

Heart Apex beat visible 4½ins. from the middle line in the fifth interspace. No extra pulsations.

Palpation. Nothing to note except displacement of apex beat.

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Percussion. Area of Superficial Cardiac Dulness diminished. It extends from the upper border of the fifth rib outwards for one inch and down to the upper border of the sixth rib.

Area of Deep Dulness- $1\frac{1}{2}/4\frac{3}{4}$.

Auscultation. Pulmonary Second Sound accentuated. Other heart sounds normal.

Blood Count. R.B.C. 5,950,000

Hb. 95%

Colour Index. 0.81.

W.B.C. 8,600.

Alimentary System. Patient complains of loss of appetite, but examination of this system is entirely negative.

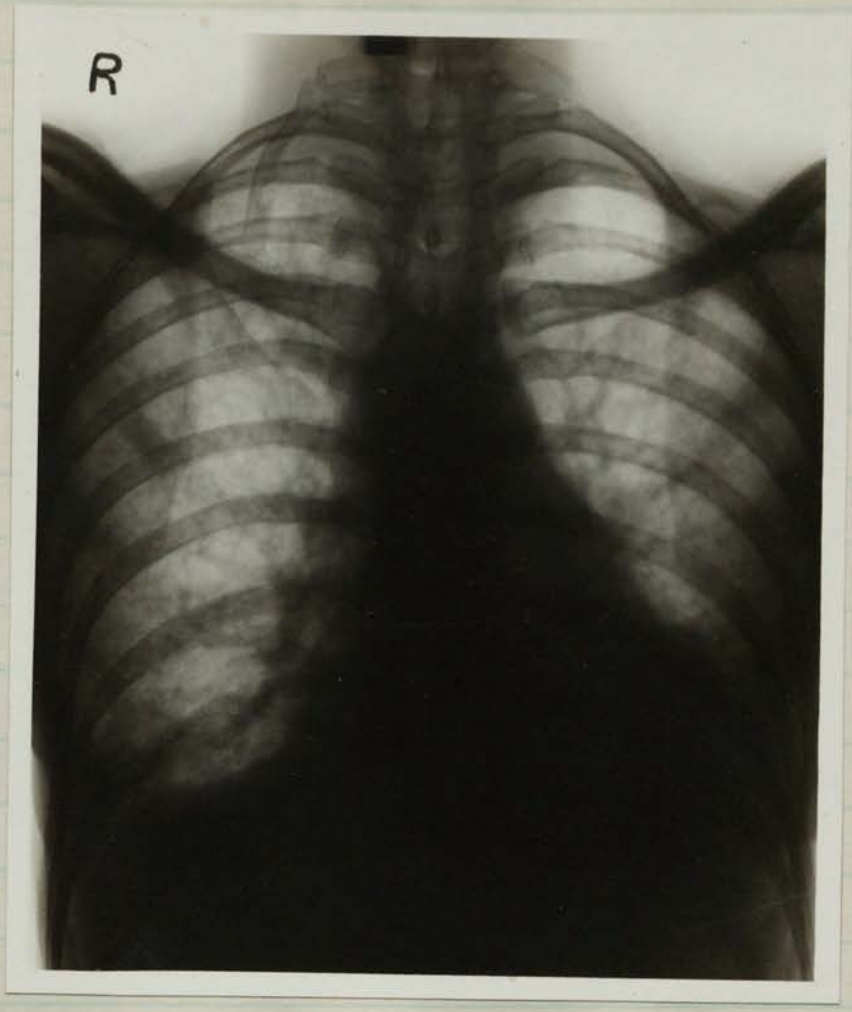
Integumentary System. In one of her fingers, there is imbedded a small piece of asbestos which must have been there before she stopped work. The skin round is raised and thickened giving the appearance of a corn. These are extremely common among these workers and they all believe that it is the asbestos which 'grows'. Mrs Slater states that "she picks out the 'Asbestos'

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every three weeks or so. In a few days, it starts growing again, and begins to get painful at the end of a fortnight so she again removes it."
I examined the material which she removed, under the microscope but found only a mass of epithelial cells - no asbestos.

All other systems were examined and found normal.

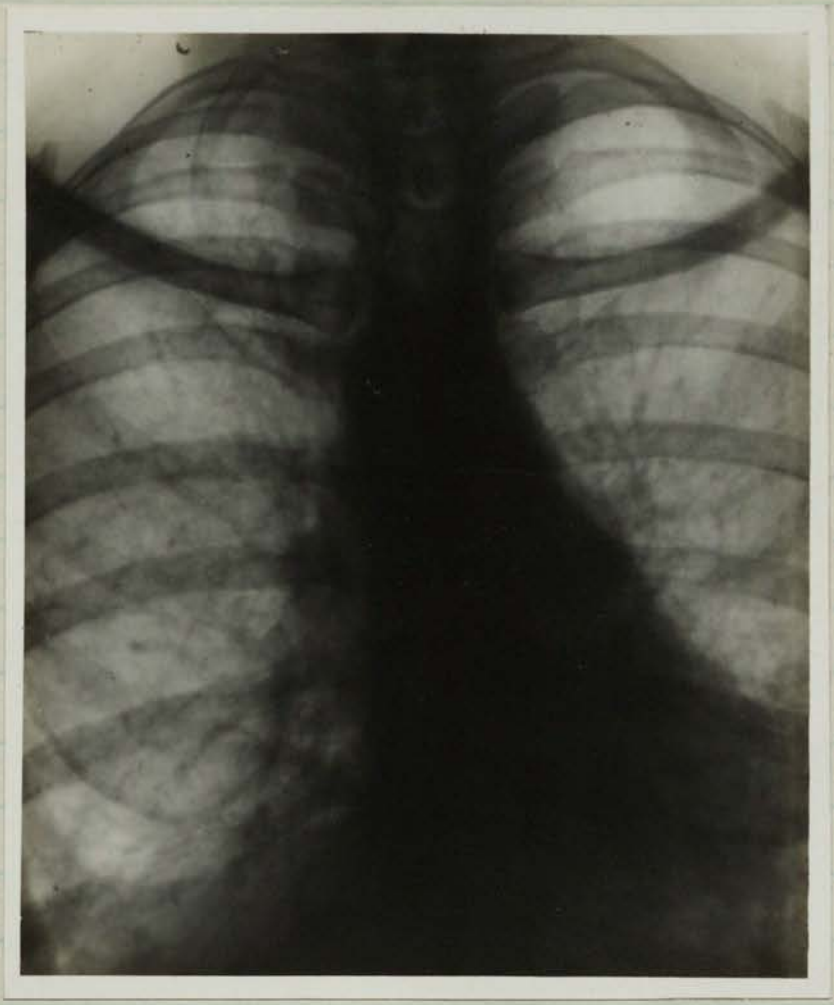
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Mrs. Slater. August. 1927.

Outlines of both sides of diaphragm obscured owing to infiltration of bases of lungs. Coarse mottling of bases of lungs with tendency towards cavity formation. Some emphysema of the upper parts of both lungs. Heart shadow displaced a little to the left. Note cervical rib (right side) No symptoms.

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Mrs. Slater. August. 1926.

This radiogram was taken at the Tuberculosis Dispensary and unfortunately, it does not include the diaphragm. It is reproduced here in order that the condition of the lungs at one year's interval may be compared.

C A S E NO. 5.

Lily Hemsley. aged 39 years. Married.

Occupation. Mattress Maker for the last twenty years.

Complaint. Loss of weight, Shortnes of breath and Asthma.

Duration. Since 1923.

History. Patient first complained in 1923 of shortness of breath associated with recurrent attacks of asthma. These, at first, were slight but have become progressively worse since. The Bronchitis is of a permanent nature varying only in intensity.

The notes then made on her panel card were:-

'On inspection, the right side of the chest lags behind the left - neither expand normally.

On palpation, the loss of expansion was again noted. Vocal fremitus was diminished.

Percussion. Left Lung. Resonant both supra-clavicularly and infraclavicularly. Dull at root and base, posteriorly. Right Lung - dull at base.

Auscultation. Left Lung. Coarse crepitations all over and friction at the base. Breath sounds coarse at apex with prolonged expiration.

Right lung.- Faint breath sounds except at the apex where they are coarser and broncho-vesicular in type. Crepitations are heard at root and base.

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Family History. Father died, aged 61 years, from Senile Decay. He was always 'chesty' for eight years before his death.

Mother aged 60. Also an Asbestos worker. Alive and well.

One Brother. Furnaceman. Suffers from Bronchitis.

No miscarriages. One child born on the 10th April, '26.

State on Examination.

Patient is of average intelligence. Her height is 5ft. 5ins., her weight 8st. 3 lbs. (two years ago, the patient weighed 11 stone.) The patient is cyanosed and breathing is a conscious effort.

Respiratory System.

Subjective phenomena. Breathlessness, cough and attacks of Asthma. In May 1927, she had a Haemoptysis for the first time. The sputum is small in amount, but when present, it is purulent. No Tubercle Bacilli were found on two separate examinations.

Breathing - mainly thoracic; rate 24 per minute.

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Thorax.

Inspection. The chest is well covered, and the extraordinary muscles of respiration are always in play. Expansion at the level of the fourth rib is ¾ inch; below the breast expansion is ½ inch.

Palpation. Confirms the observations on inspection. The Vocal Fremitus is diminished generally.

Percussion. Both apices are hyper-resonant, but the bases are distinctly dull - escpecially the right.

Auscultation. The Respiratory murmur is coarse all over with prolonged expiration. At the bases, the breathing is broncho-vesicular accompanied by coarse crepitations and friction - more marked on the right side. Friction is also heard in the right scapular region, and in the left side, near the base in the mid-axillary line.

Circulatory System.

Subjective Phenomena. The patient suffers from pain in the left side and dyspnoea - with or without exertion. She also complains of feeling very tired in the mornings.

Pulse. Arterial wall palpable and tortuous. Rate 94 per minute. Rhythm regular, and the arterial wave appears normal. Blood pressure - Systolic 138 mm.

Diastolic 96 mm.

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Heart.

Inspection. Nothing to note.

Palpation. Apex beat not palpable. No thrills.

Percussion. Area of superficial cardiac dulness diminished.

Area of Deep Dulness - $\frac{3}{1/4}$.

Auscultation. Mitral Area - there is a bruit - systolic in time, which is conducted to the axilla. The Pulmonary Second Sound is accentuated. Other Heart sounds normal.

Haemopoietic System.

Blood Count.

R.B.C.	6,110,000.
Hb.	97%
C.I.	0.79.
W.B.C.	9,800.

No abnormal cells.

Alimentary System.

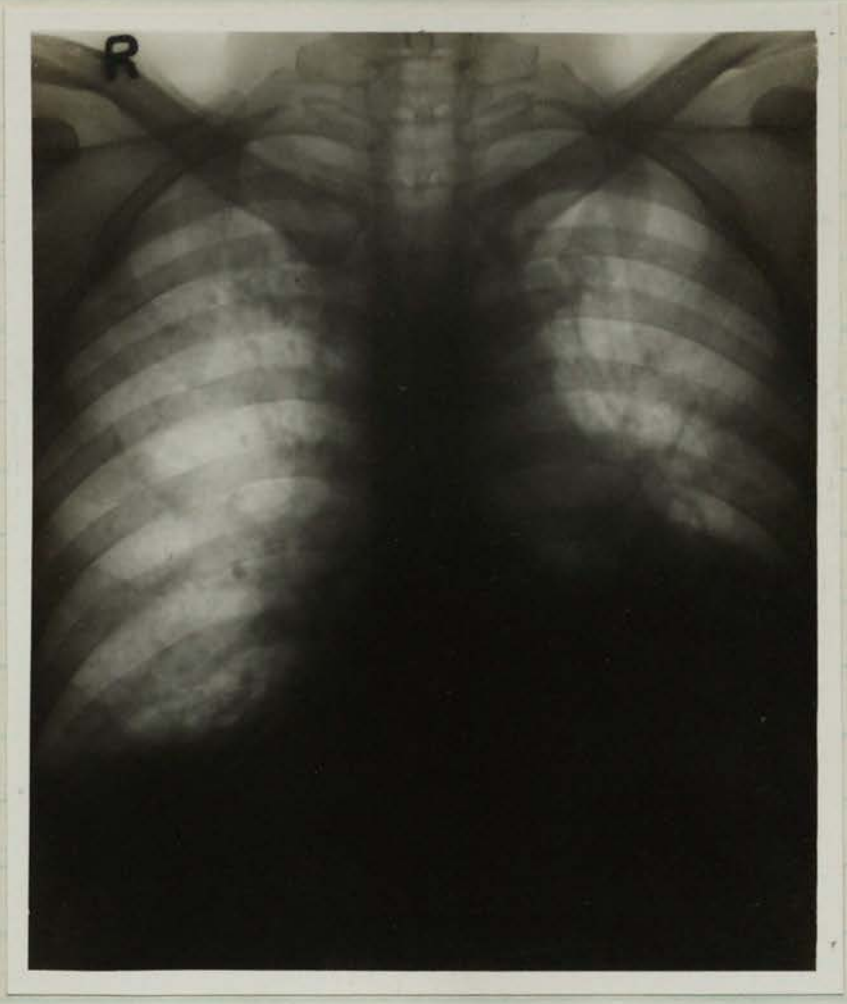
Subjective Phenomena.

Appetite varies from day to day.

On Examination.

Everything appears quite normal, but the appetite improved on 15 minims of dilute Hydrochloric Acid together with 3 minims of dilute Hydrocyanic Acid. thrice daily with food.

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Mrs. Hemsley.

Outline of both sides of diaphragm obscured as a result of infiltration of the bases of both lungs. Marked diminution of radiolucency and coarse mottling of the bases of both lungs - especially the left. Tendency towards cavity formation at base of both lungs. Apices clear.

Heart shadow displaced a little to the left.

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C A S E No. 4.

Edith Parish. Aged 37 years. Married.

Occupation. Mattress maker for 20 years.

Complaint. Cough, loss of weight, night sweats, and general debility.

Duration. She has not been fit for many years and has to have medicine most of the time although she varies from week to week.

History. Her illness started insidiously quite a number of years ago with a hard dry cough associated with expectoration, night sweats and loss of weight. Lately, the cough has improved very much and she has no sputum; the night sweats are only occasional and her weight remains steady.

Family History. Father. Aged 61 years - has always been 'chesty'. Died from Senile Decay.

Mother. Aged 60 years - an asbestos worker and suffers from chest.

One Brother - "chesty" - a furnaceman.

Two Sisters - see cases (5 and 7) Caroline Cowlam and Eva Hudson.

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State on Examination. The patient is extremely thin and delicate looking. Height - 5ft.7ins. Weight - 8st.4 lbs. She is very pale and has a tired worn expression.

Respiratory System.

Subjective Phenomena. Dyspnoea is, at present, the only thing obvious. Her cough gives her very little trouble except on waking in the mornings.

Respirations are thoraco-abdomenal in type. Rate 22 per minute.

The Sputum, when present, is muco-purulent and has been examined for the Tubercle Bacillus but none have been found.

Thorax.

Inspection. The chest is flat and the apices are sunken. Expansion is poor - $28\frac{1}{2}$ - $29\frac{1}{4}$ins.

Palpation. The Vocal Fremitus is diminished over both lungs. The movements are poor - the left lagging behind the right.

Percussion. Dulness is marked over both lungs more especially the left base.

The area of superficial cardiac dulness is increased slightly.

Auscultation. The Breath Sounds are feeble all

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all/

over the right lung and, at the right root and base, there are coarse rales.

The left apex shows some faint crepitations at the height of inspiration. The left root and base shows faint breath sounds only.

Circulatory System.

Subjective Phenomena. Dyspnoea.

Pulse Arterial wall not palpable. Rate 76 per min. Rhythm regular and wave well sustained.

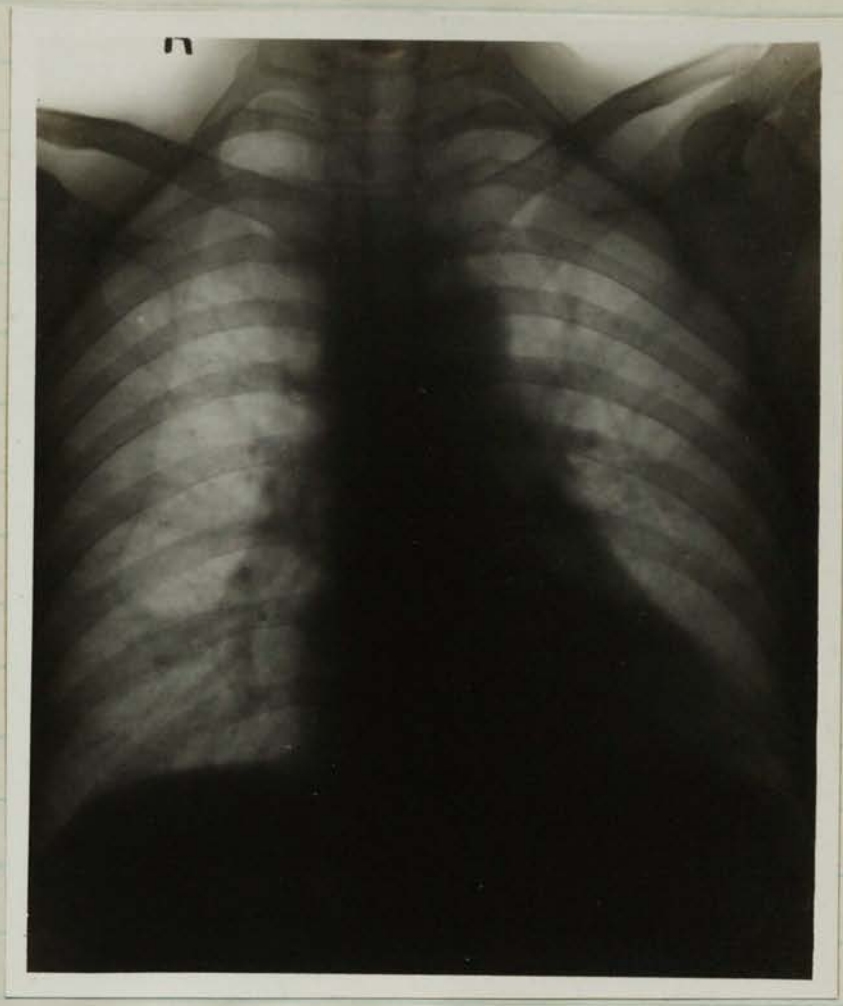
Blood Pressure by sphygmomanometer - Systolic 144.
Diastolic 98.

Heart. Nothing to note except a soft systolic murmur at the apex beat.

Blood Count. R.B.C. 3,890,000.
Hb. 65%
Colour Index. 0.85.
W.B.C. 10,400.

Other Systems were examined and found normal.

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Mrs. Parish.

Both sides of diaphragm flattened - no adhesions.
Diminished radiolucency more or less uniformly distributed throughout both lungs - a little more marked in the left lung.
Fine mottling of both lungs especially towards the bases. Root shadows contain some calcified glands.
Heart shadow normal in size, position and outline.

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C A S E No.5.

Eva Hudson. Aged 32 years. Married.

Occupation. She was a Mattress maker for 16 years. Three years ago, she left for her confinement and only returned to work a few weeks ago.

Complaint. Hard dry irritable cough.

Duration. Four years.

History. She first started with a dry, irritable cough. This particularly annoyed her as she complained that it gave her a severe pain in the epigastrium which lasted quite a long time. During the second year of her trouble, the sputum became a little more free and slimy but during all her illness, it has never been excessive.

Family History. Sister to Cases Nos. 3 and 4. No miscarriages.

State on Examination.

The patient is a healthy looking woman - Height 5 ft. 6 ins. Weight 9st. 2 lbs. There are no obvious morbid appearances.

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Respiratory System.

Subjective Phenomena. The patient complains of a hard cough with little or no sputum. The sputum when present, is tenacious and slimy. Breathlessness is not a marked feature in her case but she is more breathless on exertion than a normal healthy individual should be.

Respiration Rate - 18 per minute. The breathing is thoraco-abdominal in type. The sputum has not been examined for the Tubercle Bacillus.

Thorax.

Inspection. The chest is well covered and is a good healthy shape. The movements of both lungs are slightly impaired. Expansion:- 28 - 29¼ ins. below the bust.

Palpation. The Vocal Fremitus is diminished all over both lungs.

Percussion. The right apex above and below the clavicle is hyper-resonant but the root and base are dull. The left lung is normal at the apex and root but the note loses its resonance towards the base.

Auscultation. The Respiratory murmur at the right apex is faint - broncho-vesicular in type - and accompanied by a few clicking crepitations. All over the rest of both lungs, the breathing is faint vesicular - no accompaniments.

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Circulatory System.

Subjective Phenomena. Dyspnoea.

Pulse. Arterial wall not palpable. Rate - 78. Rhythm regular. The amplitude is fair and wave well sustained.

Blood Pressure by Sphygmomanometer - Systolic 146.
Diastolic 108.

Heart.

Inspection. Apex beat is not visible - nor are any extra pulsations to be seen.

Palpation. Apex beat felt in sixth interspace 4 ins. from the middle line.

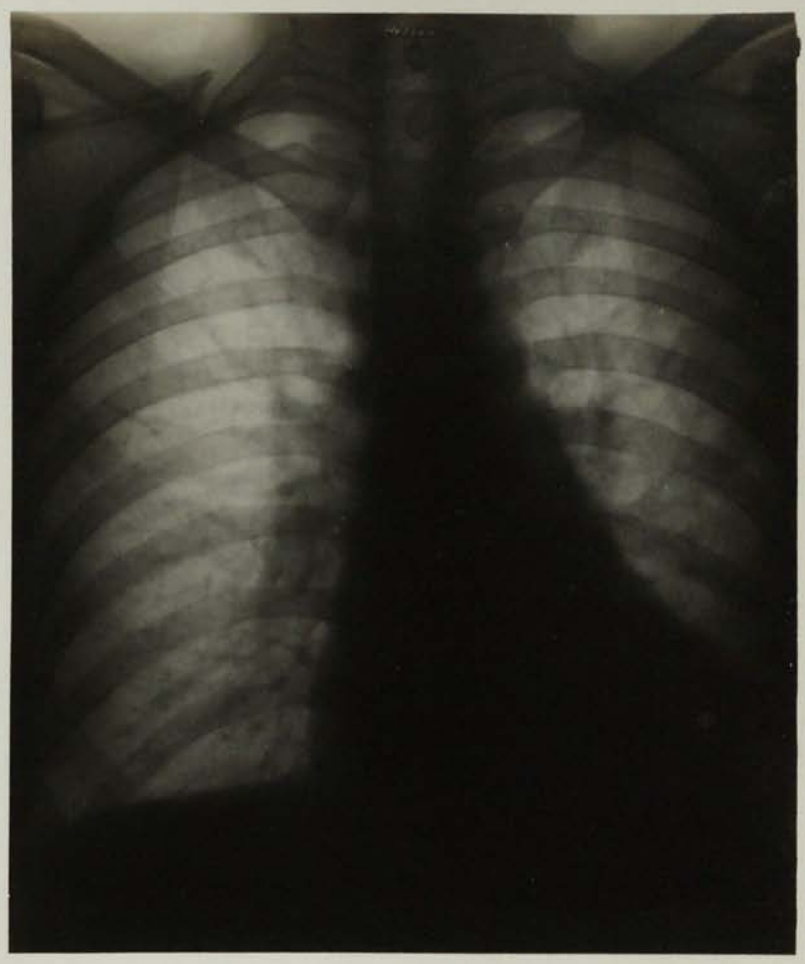
Percussion. Area of superficial cardiac dulness is slightly increased.

Area of deep dulness - $\frac{3}{1/4}$.

Auscultation. There is a faint systolic bruit at the mitral area. The pulmonary second sound is accentuated; the other heart sounds are normal.

Blood Count.		
	R.B.C.	5,200,000.
	Hb.	95%
	C.I.	0.91.
	W.B.C.	7,800.

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Mrs. Hudson.

The right side of the diaphragm is flattened. There is some peri-bronchial fibrosis of both lungs - especially towards the bases. The right base shows some coarse mottling suggesting a tendency towards cavity formation.
The heart shadow is displaced a little to the left.

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C A S E No. 6.

Walter Leadbeater. Aged 34 years. Married.

Occupation. A "Brayer" or "Beater" of mattresses - one of the dustiest processes involved in the making. He has been at this particular work since 1910 except during the period of The Great War.

Complaint. In February, 1927, he transferred to me from another doctor and complained to me about a dry and scaly eczema confined solely to the dorsum of the fingers, which had been there one month. He also complained of cough and progressive loss of weight.

History. The cough and loss of weight was first taken notice of about three years ago when his wife made him go to his doctor. He was given some medicine and cod liver oil which he continued to take for some time, but, as he did not improve at all, he gradually ceased attending and took the cough, which was dry and harsh, as a matter of course.

A month or so before coming to me, a dry and scaly eczema of the hands developed. I treated it with equal parts of Ungt.Ac.Boric, Ungt.Plumb.Acet., and Ungt.Zinci Oxid. and in the space of a week or so, it had disappeared although he had contin- at his work - wearing gloves.

He is very temperate both as regards food and drink.

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State on Examination. Patient is of average intelligence. Height 5ft. 4ins. Weight 8st. ½ lb. He shows an extreme degree of emaciation and cyanosis is striking.

Respiratory System.

Subjective phenomena. Patient complains of a very bad cough with expectoration. The cough is worse in the mornings and the act of dressing distresses him. Dyspnoea is marked on slight exertion and he has,during the last week, been given a less strenuous and less dusty job. Pain in varying parts of the chest - lasting a few days at a time - is a comparatively common complaint.
Respirations are mainly thoracic in type - 26 per minute. The sputum now is plentiful but, up to a few months ago, was almost entirely absent. It is mucopurulent and smells rather strong. No Tubercle Bacilli were found on two separate examinations.

Thorax.

Inspection. The chest is very poorly covered; there is some indrawing of the fifth space in the mid-axillary line, and both apices bulge on coughing. Measurements. 32½ -33¼ ins. minimum

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minimum/

to maximum at the nipple line.

Palpation. Expansion is poor and the right lung lags behind the left. Vocal Fremitus is diminished.

Percussion.

Left lung is hyperresonant at the apex and anterior surface but the base is dull.

Right lung, at the apex appears normal but the note at the root is dull and the base is quite flat.

Auscultation. The respiratory murmur is faint all over especially at the right base and left apex. Crepitations are heard at both bases - chiefly the right. Rhonchi are heard all over both lungs and friction sounds are heard in the mid-axillary line at the fifth interspace.

Vocal Resonance is normal in the region of the right apex but much diminished towards the base. In the left lung, resonance is diminished generally.

Circulatory System.

Subjective Phenomena. Dyspnoea, cough and pain in the region of the apex beat. The pain comes on fairly quickly and usually persists for a few days at a time. It has no relation to exertion.

Pulse. Wall palpable. Rate 88 per minute. Rhythm regular, wave full and well sustained.

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Blood Pressure by sphygmomanometer - Systolic 144.

Diastolic 106.

Heart.

Inspection. Apex Beat visible 3½ins. from the middle line. Nothing to note.

Percussion. Area of superficial cardiac dulness diminished.

Deep dulness - $\frac{3}{1/3\frac{1}{2}}$.

Auscultation. The second pulmonary sound is definitely accentuated.

Other heart sounds are normal.

Haemopoietic System. Glands of the neck, groin, axilla and elbow are enlarged and rubbery.

There is no history of Syphilis but a Wassermann test is desirable. This, up to the present, I have been unable to obtain.

Alimentary System.

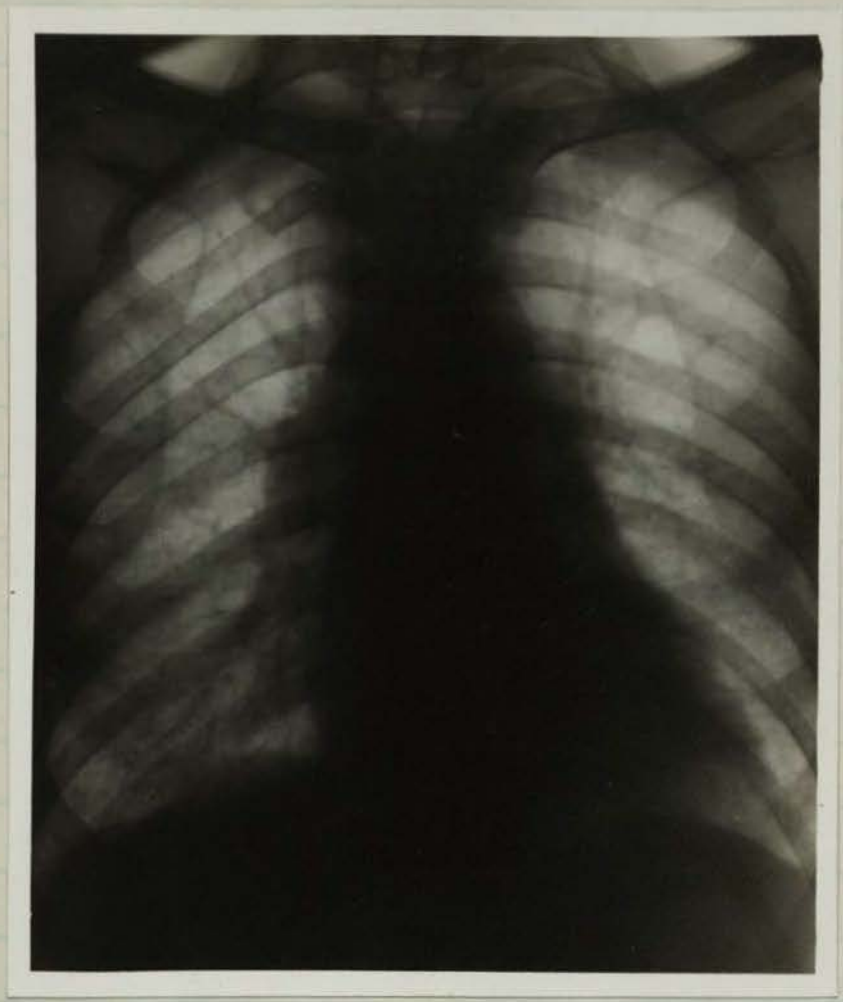
Subjective Phenomena. Loss of appetite for over a year.

On Examination. Tongue dirty and bowels stubborn.

Nothing else was found on examination.

All Other Systems. Examined and found normal.

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Mr. Leadbeater.

Elevation, obscuring of outline of the right side of diaphragm. Some flattening of the left side. Diminished radiolucency and fine mottling of the bases of both lungs - especially the right. Apices clear. Emphysema upper part of the left lung. Enlargement and increased density of right hilum shadow. Adhesion between the lowest and middle lobes of right lung (5th space, mid-Axillary line). Heart shadow normal in size, outline and position.

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C A S E NO. 7.

Caroline Cowlam. Aged 37 years. Married.
Occupation. Mattress Maker for the last 12 years, but has not worked for two years.
Complaint. Shortness of breath, and cough.
Duration of present illness. Eleven years.

History. Eleven years ago, she was seen by Dr. Woodcock, the Tuberculosis Officer for Leeds, who had her radiographed, and told her "it was not Phthisis but a definite chest complaint". She continued at her work until two years ago with only occasional periods off with bronchitis.
She has always, since a girl, "been inclined to catch cold". Notes made on her panel card in December 1926 by Dr. Haddow, state that"both bases were dull, and the Respiratory murmur poor. There were rales at the angle of the left scapula, and moist sounds, post-tussis, all over the chest. The cough was bad with a lot of expectoration.
Weight 7st. 11 lbs. General condition 'fair'.

Family History. is bad, but as the rest of the family also work, or have worked, at the Asbestos Factory, this is to be expected. She has four children, aged 12; 11; 6; and 1½ years respectively - all well and healthy. No miscarriages.

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State on Examination.

Intelligence average. Height 5ft. 3ins. Weight 7st. 7 lbs. Her skin is slightly bronzed, but she looks fairly well.

Respiratory System.

Subjective Phenomena. Her chief complaints are, cough and breathlessness, with pain occasionally in various parts of the chest. There is a fair amount of sputum from time to time.

The breathing is mainly thoracic. 20 per minute whilst resting. The sputum is muco-purulent, and, although examined many times for the Tubercle Bacillus, has always been reported negative.

Thorax.

Inspection. The chest is barrel shaped; the apices are sunken and bulge on coughing. Respiration is always an effort.

Expansion is poor; at the nipple line, the chest measures 27 inches, and 27¾ inches on full inspiration.

Palpation. The chest movements are slight, and the Vocal Fremitus is diminished all over.

Percussion. Left lung is slightly hyper-resonant at

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at/

the apex but becomes slightly dull towards the base. Infraclavicularly, there is hyper-resonance. The right lung is considerably duller than the left except the apex, which is normal. The dullness is especially marked at the root and base. The Vocal Fremitus is generally diminished throughout both lungs.

Auscultation. The respiratory murmur is poor all over but especially at the bases. The breath sounds at the right apex are coarser, and all over the lungs there are faint crepitations with occasional rales. The Vocal resonance is diminished. Faint friction is heard at the right base.

Circulatory System.

Subjective Phenomena. Cough, Dyspnoea and pain.

Pulse. Arterial wall not palpable. Rate 100 per minute. Rhythm regular. Wave fairly well sustained.

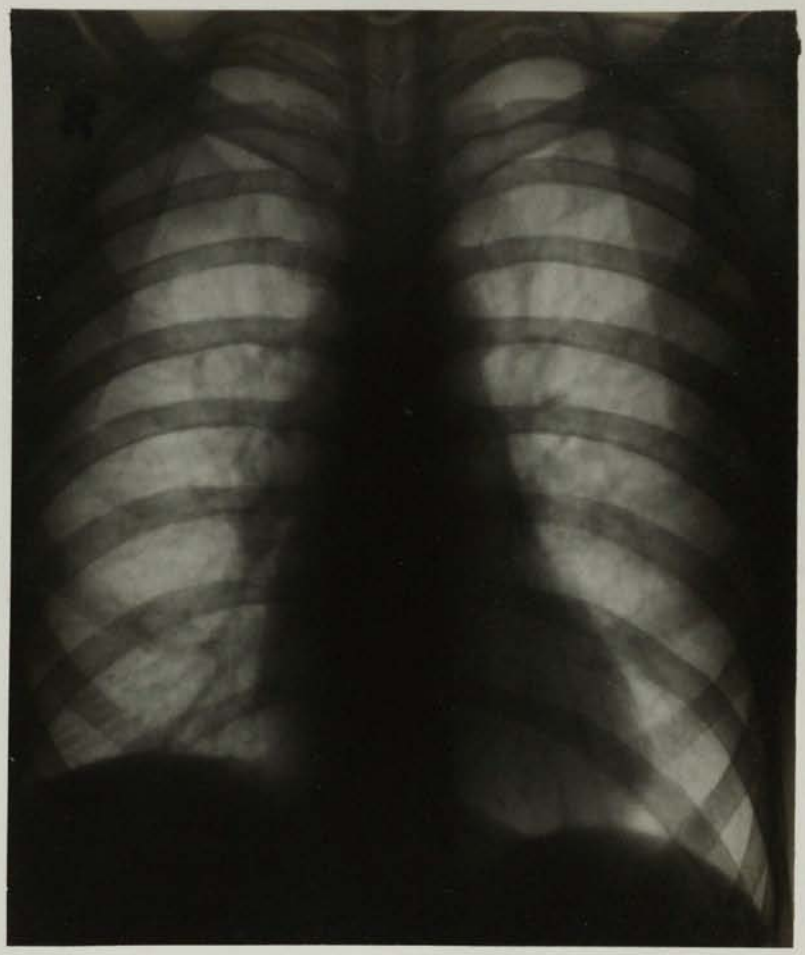
Blood Pressure by sphygmomanometer - Systolic 120.
Diastolic 94.

Heart. Apex beat diffused, and extends four inches from the sternum - ½ inch outside the nipple line.

Palpation.)
Percussion.) Nothing to note.
Auscultation.) Pulmonary second sound accentuated ?

Other systems. Nothing to note.

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Mrs. Cowlam.

Flattening and elevation of right side of diaphragm. Left side of diaphragm normal. Diminished radiolucency and peribronchial infiltration of the base of the right lung. Apices clear. Left lung normal. Some emphysema both lungs. Right root shadow denser than normal. Heart shadow normal in size, outline and position.

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C A S E No. 8.

Doris Leadbeater. Aged 27 years. Married.

Occupation. Mattress Maker for the last 12 years, except for a period of two years when she was confined (September 1923).

Complaint. Shortness of breath, loss of appetite and cough.

Duration. Since February 1927.

History. The condition came on insidiously, commencing with shortness of breath on very slight exertion such as going upstairs. She next developed a dry cough with no expectoration which was worse with any change of atmosphere. Associated with these symptoms, there was loss of appetite.

Previous Illnesses. In 1923 when she was off work following her confinement, she complained of tiredness and shortness of breath on exertion.

In October, 1925, she again came to the surgery suffering with the same complaint.

She has only been pregnant once when she was delivered of a healthy boy.

Family History. Father. Alive and well.

Mother. See Case 2.

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State on Examination. Average intelligence. Height 5ft. 4ins. Weight 8st. 1 lbs. She is well developed and fairly muscular. Her expression is cheerful and, apart from a slight degree of cyanosis, looks healthy.

Respiratory System.

Subjective Phenomena. Cough and Dyspnoea.

Respirations - 20 per minute when resting. - thoracic in type - quiet and regular.

Sputum is almost always absent but, when present, has been examined for the Tubercle Bacillus and proved negative.

Thorax.

Inspection. The chest is well covered and of normal symetry except for a slight lagging of the Right Apex. Measurements.- At the level of the 4th. rib - 29½ - 30¼ ins. - Below bust 28½ - 29ins.

Palpation. confirms inspection. Vocal Fremitus is diminished.

Percussion. Right apex and both bases are dull. Left apex is normal. Anteriorly, there are several small hyper-resonant areas.

Auscultation. The Respiratory Murmur generally was diminished, particularly at the Right Apex and

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and/

both bases. A few faint clicking crepitations were heard at the right apex and right root. In the axilla, there was faint friction. The vocal resonance was diminished all over the right lung and left base; the upper part of the left lung was normal.

Circulatory System.

Subjective Phenomena. Dyspnoea and cough.

Pulse. Arterial wall not palpable; Rate 78 per minute; rhythm regular; wave well sustained.

Blood Pressure by sphygmomanometer - Systolic 125.
Diastolic 100.

Heart.

Inspection. Nothing to note. Apex beat not palpable.

Palpation. Apex beat displaced slightly to the left.

Percussion. Area of Superficial Cardiac Dulness diminished slightly.

Deep Dulness. $\frac{3}{1/4\frac{1}{4}}$

Auscultation. Heart sounds normal.

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Alimentary System.

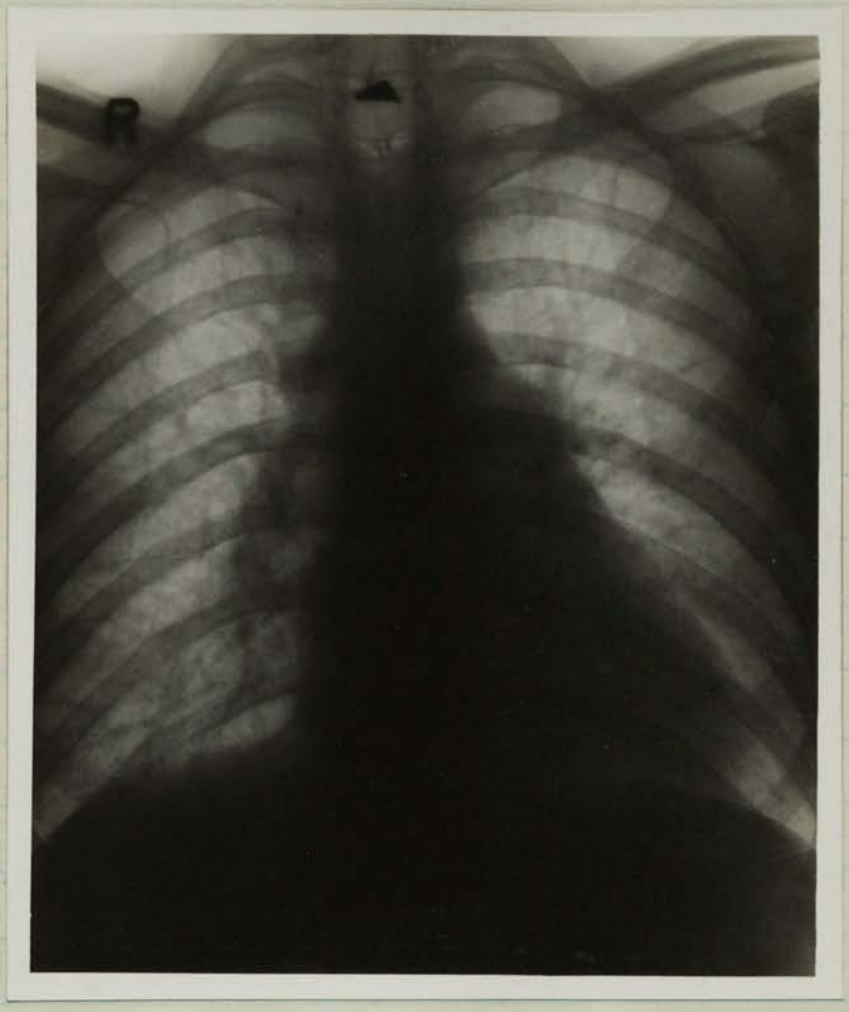
Subjective Phenomena. Anorexia. Even when the chest symptoms are negligable, the appetite is poor. Teeth are good and kept clean. The tongue is dirty at the base. The bowels are inclined to be stubborn and have to be helped by liquid paraffin.

Abdomen.

Nothing to be made out abnormal on examination.

Other systems were examined and found normal.

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Mrs. Leadbeater.

Elevation and flattening of the right side of the diaphragm. Flattening of the left side.

Infiltration and fine mottling of both bases.

Enlargement and increased density of the right root shadow. Very fine (early) infiltration of the apices.

Heart shadow a little enlarged to the left.

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C A S E NO. 9.

Jessie Mathers aged 24 years. Married.
Occupation. Mattress Maker for the last 11 years.
Complaint. Shortness of breath, morning cough and loss of appetite.
Date of examination. 26th May, 1927.

History. In August 1923, the patient complained of loss of appetite, sleeplessness and palpitation. The palpitation came on at no special time -- sometimes whilst at work, and sometimes in bed. The notes on her panel card are brief:- 'Tongue clean and moist; Heart sounds normal; Pulse rate 72 per minute; nothing to note in the Abdomen.'

At that time she was off work for some seven weeks. She was next seen in October 1924, when she suffered simply from an acute Bronchitis and apparently completely recovered. In August 1925, she came to me with an Urticarial rash on the face almost immediately followed by a Fibrositis confined to the shoulders and arms. She was then off work for one month. In March 1926, she had Influenza - Temperature 102°, pains all over, and a dry irritating cough. The only physical signs noted were a few clicking post-tussis crepitations at the left apex. October 1926 found her again at the Surgery, complaining of sickness, pains in the Epigastrium immediately after food, and constipation. She was 'thrown on' but shortly was referred for examination by the Medical

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Medical/

Referee who reported her to be suffering from slight bronchial catarrh out fit for work.

I found on examining her then that there were fine crepitations at the left apex, left root and both bases. The area of superficial cardiac dulness was diminished and the pulse rate was 86 per minute.

I did not grant a final certificate on the strength of these findings. She has not since returned to work.

Family History. Father died aged 36 years from Pneumonia. There is no previous history of chest trouble.

Mother is alive and well.

No brothers or sisters.

Nullipara. No miscarriages. She has just undergone the operation of amputation of the cervix for sterility.

State on Examination.

The patient is of average intelligence. Height 5ft. 2½ins. Weight 8st. 5 lbs. She has lost 5 lbs since stopping work seven months ago. Patient is stout and well developed , and of a cheerful disposition. Her lips and cheeks are rather cyanosed with whitish patches, rather resembling an enema rash.

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Respiratory System.

Subjective Phenomena. Breathlessness on slight exertion such as shaking a rug or going upstairs. Her cough is troublesome chiefly in the morning. Breathing - Thoracic in type; rate 24 per minute. Sputum - only very occasionally present - generally clear and frothy but occasionally purulent. No Tubercle Bacilli present.

Thorax.

Inspection. The chest is broad and well covered, and there is nothing morbid to notice except that the left apex lags behind the right on inspiration.

Measurements - below bust 27 ins. - 27¾ ins.

fourth rib 27½ ins. - 28¾ ins.

Palpation. Confirms the findings on inspection. Vocal Fremitus diminished slightly.

Percussion. Left lung is dull all over but particularly at the apex infraclavicularly and the base. The area of superficial cardiac dulness is diminished and there is a zone of resonance anteriorly at the level of the fourth rib.

Right lung is dull both above and below the clavicle. There are areas of hyper-resonance posteriorly in the region os the angle of the scapula.

Auscultation. The Respiratory murmur was faint all over both lungs - broncho-vesicular at the left apex and root but vesicular elsewhere. All the posterior

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Posterior/
Aspect of the left lung showed faint post-tussis crepitations with friction at the level of the angle of the scapula. In the right lung, friction was heard anteriorly at the level of the third rib; posteriorly, at the base, friction and rhonchi were heard but the former was extremely faint.

Circulatory System.

Subjective Phenomena. Palpitation with no relation to exertion. Dyspnoea on slight exertion.

Pulse. Arterial wall not palpable. Rate 86 per min. Wave is low but fairly well sustained.

Blood pressure by sphygmomanometer - Systolic 120 mm.
Diastolic 98 mm.

Heart.

Inspection. Nothing to note.

Palpation. Apex beat barely palpable even on leaning forward.

Percussion. Superficial cardial dulness diminished. It commences at the fourth rib - laterally for $\frac{3}{4}$ in. and down to upper border of sixth rib.
Area of Deep Dulness - $1\frac{3}{4}/4$.

Auscultation. Pulmonary Second Sound slightly accentuated. Other Heart sounds normal.

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Haemopoietic System.

Blood Count. R.B.C. 6,570,000.

Hb. 90%

C.I. 0.69.

W.B.C. 12,600.

No abnormal cells.

Alimentary System.

Subjective Phenomena.

In August 1923, she first complained of loss of appetite associated with tachycardia and insomnia. She had no pain at any time in the abdomen - no nausea or heartburn, only an extreme distaste for food.

Lips are slightly cyanosed, teeth good, tongue rather dirty at the base.

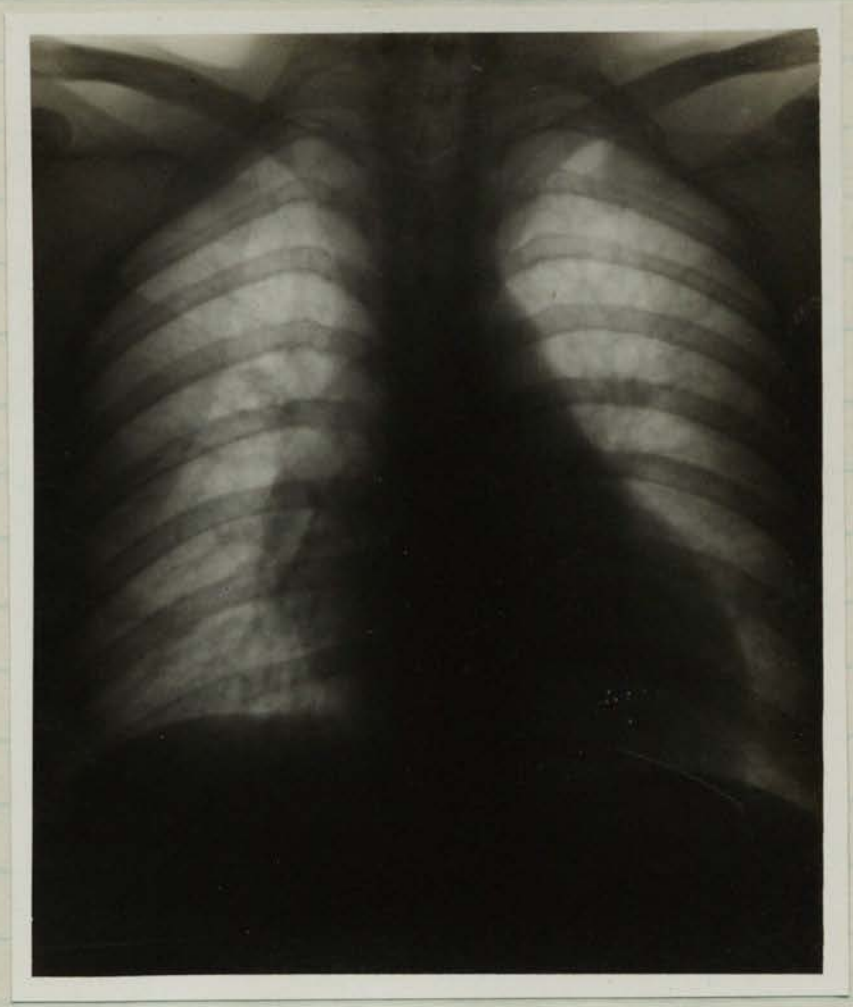
Bowels generally constipated. She has to take liquid paraffin regularly and other laxatives occasionally.

On Examination.

There was nothing to note except a mass in the left Iliac region which disappeared on taking some opening medicine.

Other Systems. Nothing to note.

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Mrs. Mathers.

Diaphragm normal in outline and position - both sides. Fine mottling at base of left lung. Some peribronchial infiltration at base of right lung. Both apices clear. Some enlargement and increased density of the right hilum shadow, which contains some calcified glands. Heart shadow normal in size, outline and position.

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C A S E No. 10.

Hilda Jagger. Aged 25 years. Single.

Occupation. Three years on making ropes and rings followed by mattress making for six years.

Complaint. Cough without expectoration and Dyspnoea.

Duration. She first attended her own doctor two years ago.

History. Her cough and dyspnoea first became troublesome about two years ago when she had medicine for a long time. The cough became a good deal easier but the dyspnoea continued. Palpitation also was a troublesome feature.

Family History. Father and Mother both alive and well.

State on Examination.

The patient is a spare, tall girl, slightly bronzed and with a malar flush.

Height 5ft. 6ins. Weight 7st.

Respiratory System.

Subjective Phenomena. The only complaint at the present moment is dyspnoea - especially marked on exertion. The cough is relatively

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relatively/
slight and unimportant.

The breathing is thoracic in type with a rate of 22 per minute.

The sputum has not been examined for the Tubercle Bacillus.

Thorax.

Inspection. The patient has a very thin flat chest with sunken apices. On expansion, the left side lags behind the right. Expansion 23 - 24 ins.

Palpation. Inspection confirmed. The Vocal Fremitus is diminished at both apices - especially the left. The rest of the lungs give normal fremitus.

Percussion. Dulness at both apices - more so on the left than the right. The right lung is slightly hyper-resonant anteriorly and at the apex posteriorly.

Auscultation. The Respiratory Murmur is faint all over the lungs except at the right apex posteriorly where the breathing is harsh broncho-vesicular with prolonged expiration and accompanied by moist crepitations at the height of inspiration. Pectoriloquay is exhibited. The respirations at the bases approach the normal.

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Circulatory System.

Subjective Phenomena. The patient complains of breathlessness on exertion and attacks of palpitation. The dyspnoea is increased on exertion but the palpitation is just as liable to come on in bed as during exercise.

Pulse. Arterial wall is not palpable. Rate 104 per minute resting. Rhythm regular but the rate is easily increased. Wave weak and not well sustained.

Blood Pressure by shpygmomanometer - Systolic 120.
Diastolic 88.

Heart.

Inspection. Apex beat is visible 4¼ins. from the middle line. Nothing else to note.

Palpation. Confirms inspection.

Percussion. Area of Superficial Cardiac Dulness slightly increased.

Deep Dulness - $\frac{3}{1/4\frac{1}{4}}$.

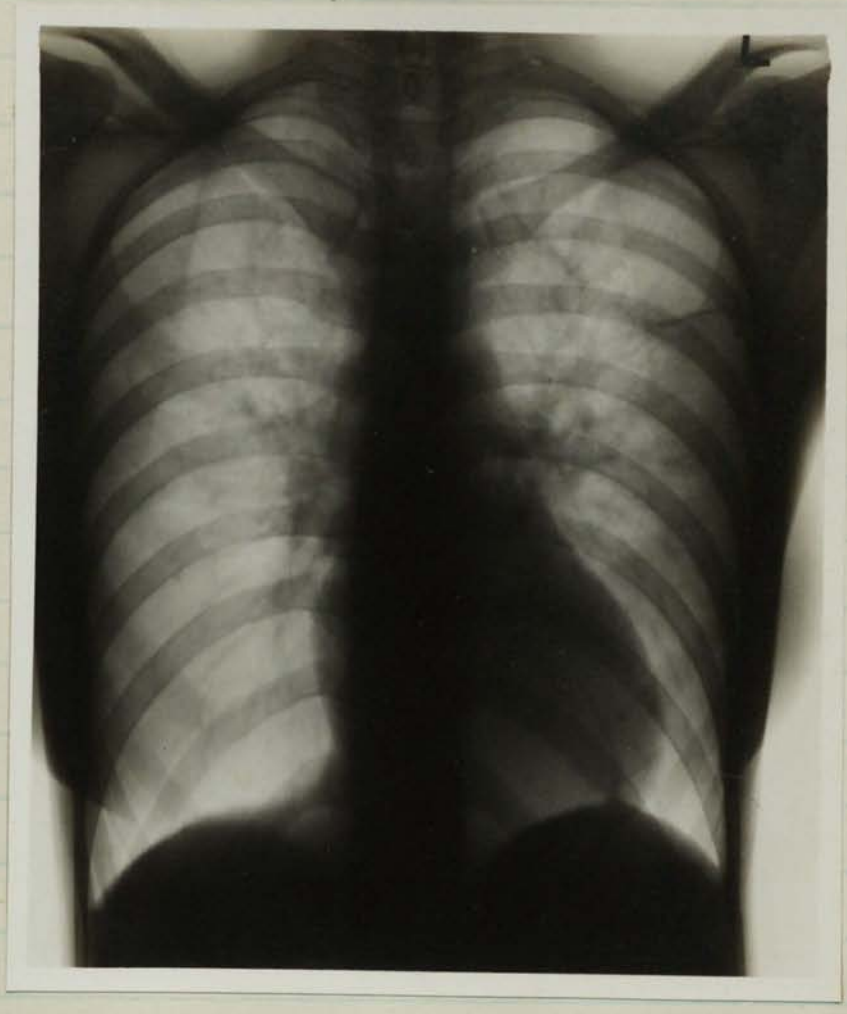
Auscultation. Heart Sounds at all areas are pure but feeble with the exception of the second pulmonary sound which is relatively loud.

Blood Count. R.B.C. 5,400,000.
Hb. 95%
C.I. 0.88.

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All Other Systems were examined but, with the exception of five small callosities on the fingers due to the entrance of small pieces of asbestos dust through abrasions in the skin as described in Case 2., they were all found normal.

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Miss Jagger.

The right side of the diaphragm is normal; there is an adhesion between the lung and the left side of the diaphragm. The root shadows are larger than normal and there is evidence of some peribronchial fibrosis extending outwards towards the apices of the lungs; the fibrosis is most marked on the left side. The x-ray appearances are suggestive of a Hilar Tuberculosis which is tending to extend outwards towards the apices.

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C A S E No. 11.

Florence Stobbs. Aged 26 years. Married.

Occupation. Twister for five years. This room is not very dusty.

Complaint. Nil. at present. She attended the surgery at my request.

History. She first came to us with Sickness of Pregnancy in August 1926. Treatment with Glucose was a marked success. During the latter months of her pregnancy, the urine was very offensive and albumen was present in large amount.
She went to full term and delivery was natural. About a month after, she suffered from general debility and tachycardia. At that time, her pulse rate was 120 per minute and her heart sounds normal.

Family History. Father. died aged 53 years. Killed at work.
Mother. aged 61 years - alive and well.
One child - healthy.

State on Examination. She is a puny little thing - pale and weary looking.

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Respiratory System.

Subjective Phenomena. Cough and shortness of breath on exertion. The cough now only troubles her in the mornings. Sputum is absent but, when present, was examined for the presence of Tubercle Bacilli but without result.

Thorax.

Inspection. The chest is flattened and the apices are sunken. Breathing thoraco-abdominal in type.

Palpation. Right apex lags behind left. Expansion one inch at the bases. Vocal Fremitus is diminished generally.

Percussion. There is generalised dullness all over both lungs with the exception of the right apex anteriorly and posteriorly where there is hyper-resonance.

Auscultation. Respiratory murmur is faint at the bases and roots and left apex. There are no accompaniments. At the Right apex, the murmur is harsh and the breathing is almost amphoric in quality. Many moist clicking crepitations and tinkling rales are also heard in this area.

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Haemopoietic System.

Glands anterior to the Sterno-Mastoid palpable.

Other glands normal.

Blood Count.	R.B.C.	4,200,000.
	Hb.	80%
	C.I.	0.95.
	W.B.C.	9,800.

All Other Systems were examined but nothing abnormal was found.

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C A S E No. 12.

Doris Pantry. Aged 20 years. Single.

Occupation. Carder for the last three years.

Complaint. None at present.

History. The patient came to the surgery at my request so that I might examine her to see if her work had yet had any effect on her lungs.

Past History. She has had no illnesses of any importance except that she came to the surgery in May, 1926, complaining of a cough - hard and dry - which kept her awake at night. This cleared up rapidly with a simple expectorant mixture.

Family History. Father. aged 70 years. Alive and well.

Mother. aged 67 years. Alive and well.

Two brothers and sisters. Alive and well.

State on Examination. The patient is a perfectly normal, cheery girl to all appearances.

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Respiratory System.

Subjective Phenomena. Nil.

Thorax.

The chest appears to be absolutely normal on examination.

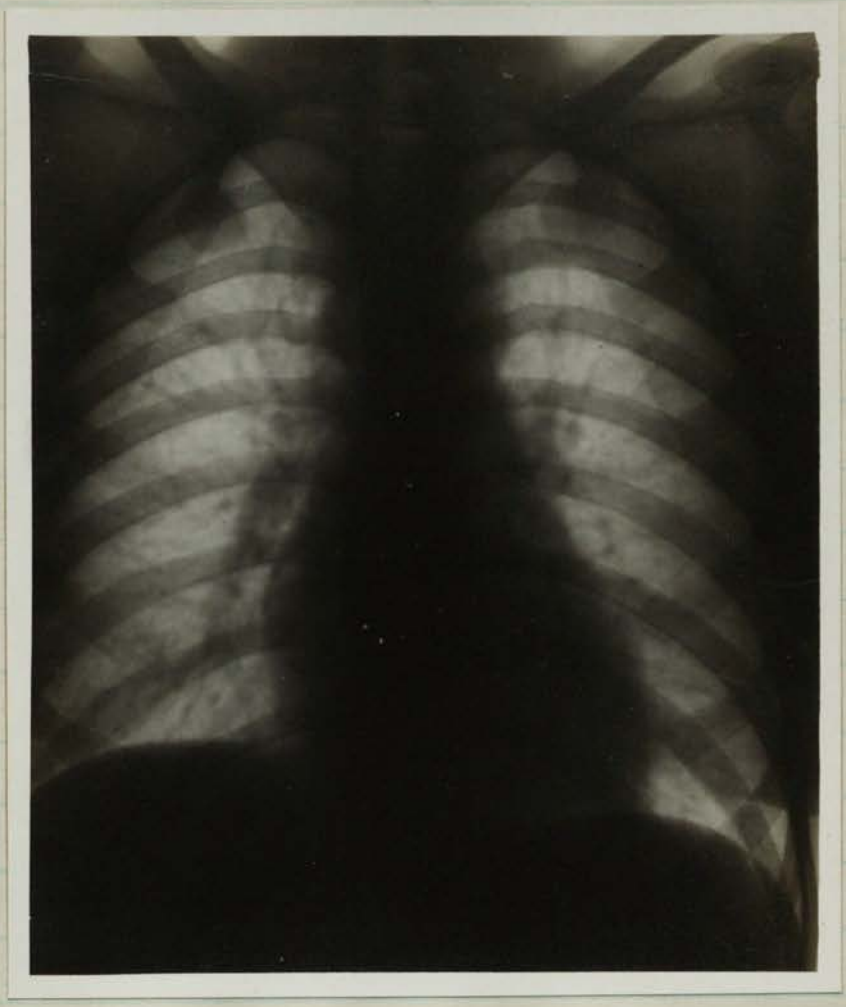
Does the x-ray show the commencement of the pathological process before physical signs are apparent?

Heart. This organ too is normal except for a systolic bruit confined to the apex beat.

Blood Count.	R.B.C.	4,220,000.
	H.B.	85%
	C.I.	0.98.

Other Systems nothing to note.

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Miss. Pantrey.

Both sides of diaphragm normal in outline - no adhesions. Slight mottling (coarse) base of right lung - otherwise lungs (radiographically) normal. Root shadows normal. Heart shadow normal in size, position and outline.

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C A S E No. 13.

Winifred Ryder. Aged 21 years. Single.
Occupation. Twister for three years after which she became a metal worker. Last year, she resumed her former employment.
Complaint. Nil.

History. Notes from her panel card. -
January, 1925. Suffered from Bronchitis for two months.
April, 1926. Acute tonsillitis with Tinnitus.
September, 1926. Complains of headache and tinnitus. - referred to Aural Specialist at Leeds General Infirmary.

In March, 1927., she came to me when she complained of loss in weight and dyspepsia. Her weight then was 7st. 9 lbs., having lost half a stone in eight months.
On examination, the chest only showed slight dulness at both bases with faint respiratory murmur. The Vocal Fremitus and Resonance were slightly diminished there also. there was nothing else noted on the chest.
The Tongue was dirty towards the base and the bowels were stubborn. 'Warty Growths' on the hands were numerous.
This patient has now left the district.

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C A S E No.14.

Ida Welford. Aged 19 years. Married.

Occupation. 'Carder' for three years - one of the dustiest rooms in the Works.

Complaint. Dry cough only.

Duration. One year.

History. This patient states that she has had a cough every Autumn and Spring since she was a child.

She first attended the surgery in July, 1926 when she complained of a lump in the left breast which, on removal, proved to be an Adenoma.

Soon after this she was married and her confinement took place in March, 1927. For two months after this, she was unable to return to work on account of cough and 'general debility'.

Family History. Father. died aged 45 years from Pneumonia.

Mother. aged 40 years - alive and well.

Large family of brothers and sisters - all alive and well.

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Respiratory System.

Subjective Phenomena. Her only complaint at the moment is of a cough - dry and irritating which keeps her awake at night. No Tubercle Bacilli were found in the sputum when it was present.

There is no great degree of breathlessness.

Thorax.

Inspection. The chest looks perfectly normal and is well covered. There is a firm scar - semicircular in shape - below the left breast, left after the removal of an adenoma.

Palpation. The chest movements are fair - the left apex, however, lagging a little behind the right. The Vocal Fremitus is slightly diminished at both bases. Expansion at the bases - $28\frac{1}{4}$-$29\frac{3}{4}$ ins.

Percussion. The left apex is hyper-resonant; both bases are dull; the remainder of the lung is of normal resonance.

Auscultation. The breath sounds are faint all over but especially so at the bases. At the left apex, the breathing is harsh broncho-vesicular with prolonged expiration - accompanied by moist sounds at the height of inspiration.
Occasional creaking rhonchi are heard all over both lungs.

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Haemopoietic System.

Blood Count.	R.B.C.	5,780,000.
	Hb.	95%
	C.I.	0.83.
	W.B.C.	6,600.

Integumentary System. The patient has many nodules on her hands similar to those described in Case 2. There is nothing else to note,

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Other Systems normal.

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C A S E No. 15.

Nellie Dickens. Aged 24 years. Single.

Occupation. Mattress Maker for 1½ years.

Complaint. Nil.

History. This patient has no complaint and, to all appearances, is a perfectly healthy normal girl. She had a cough when at school frequently, but has not had one for over three years now. At the age of 16 years, she had an abscess in the neck on the right side.

Family History. Father and Mother both alive and well.

Two Brothers alive and well.

State on Examination.

There are no morbid appearances.

Weight 7st - remaining steady. Height 5ft. lin.

On Examination. No pathological signs were discernible. The Pulse was 80; Heart normal; Lungs healthy and appetite good. She had a chest expansion of two inches below the bust.

An x-ray photograph was taken to confirm the findings and to see if trouble could be foretold by radiography before clinical examination.

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Miss Dickens.

Both sides of the diaphragm move well and are normal in outline and position. The root shadows contain a few calcified glands; they are normal in size. There are a few enlarged glands scattered along the course of the lower bronchial tubes on the right side. There is no evidence of disease of the lungs or pleura.

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CONCLUSIONS.

From a study of the evidence which I have collected, the conclusions to which I have come are that :-

1. Asbestos workers seldom survive five years in the factory without developing respiratory disease.

2. The effects are permanent, progressive and do not abate with cessation of work.

3. Twenty five years is about the longest working life and it may be as short as fifteen or sixteen years.

4. Pulmonary Tuberculosis does not supervene and is not the ultimate cause of death.

5. The "dust" of asbestos disease differs from that of other forms of Pneumokoniosis in the size, shape and distribution of the particles in the lungs.

6. The resulting fibrosis is unique, inasmuch as (A) the particles being often too large to be phagocyted, become surrounded by fibrous tissue which obstructs the lymphatic flow hilumwards, so that localised mild pleurisies are constantly being set up, and these gradually cause complete adhesion of the pleurae.

(B) the particles, being large and heavy, tend to fall into the right bronchus and so to invade the right base to begin with and to flatten the right diaphragm first.

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(C) the grossness of the particles frequently prevents their entry into the alveoli, with consequent occlusion of the bronchioles, resulting in degeneration and ultimately caseation of the alveoli beyond.

(D) the particles themselves offer unique variations in form: and certain structures which, in spite of their fungus-like (Aspergillus) appearance have not been proved to be organic at all, contribute to make the histological picture distinctive and characteristic.

7. The Fluoroscopic and Radiographic appearances are of great value in the differential diagnosis of this disease from other Pneumokoniosis and Pulmonary Tuberculosis.

8. Although much work remains to be done in the elucidation of this disease, it may reasonably be claimed that there is a strong case for including the asbestos industry in the Schedule of Dangerous Occupations.

9. Finally, Asbestosis may be defined as a chronic pneumokoniosis affecting all asbestos workers within five years, the fibrosis being basal, beginning on the right side and being accompanied by diffuse pleural adhesions, whilst the upper lobes are emphysematous, the symptoms being early dyspnoea with dry cough followed by extreme wasting, anorexia, and weakness, without fever, night sweats or Tubercle Bacilli in the Sputum, and terminating fatally in 20 to 30 years from exhaustion and intercurrent disease.

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