On Anthrax, considered chiefly in relation to the Woolsorters of Bradford.

by

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Thesis for the degree of M.D.

in the University of Edinburgh.

95 Horton Road.
Bradford.

April 1897.
Declaration

I hereby declare that the work has been done to this Thesis composed by myself.

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Bradford.

April 1899.
In the following thesis I propose to consider the subject of Anthrax chiefly as it affects the Wool-sorters of Bradford. The subject has been most able worked out by many observers - among whom may be mentioned Prof. Greenfield of Edinburgh and Dr. J.H. Bell of Bradford. Since coming to Bradford in 1887 I have been much interested in the disease, and as I have had the opportunity of seeing a number of cases, some of which I place at the end of this paper, it is to a very great extent from my own experience that the following account is written. The subject is a very large one and it will be impossible in an essay of reasonable dimensions to do more than give a brief sketch of the various divisions into which it falls.

Synonyms. Among animals the disease is known as Splenic fever, and since 1881 all deaths from Anthrax have been classed under that name in the Registrar General’s Reports. This is an ill advised term seeing that the spleen plays a very unimportant part in very many cases.
About Bradford the name of Weilcohtes' Disease is the common one. This, strictly, embraces the Pulmonary form of internal anthrax. Malignant Pustule indicates the external form. Other names are Charbon (Fr.) Male de Rok (Fr.) Milbrand (St.).

Carbuncle was formerly, though wrongly, included under the name of Anthrax. There are many other synonyms but those mentioned are among the best known. **Definition.** By the term Anthrax I understand the disease produced by the Bacillus Anthracis whether that disease be local or general. It is a specific, contagious infectious disease & is usually communicated to man from animals which have suffered from septicemic fever. In Bradford it is usually induced by the manipulation of diseased wool.

**History.** This disease was observed in Bradford for the first time in 1837 when alpaca & mohair were first introduced into the town. At first the mysterious disease which attacked wool growers was put down to many things, but it was thought by the more observant that it was exceedingly strange
That nearly all or I might say all the people attacked were men employed either in opening the bales of wool on their arrival from foreign parts, sorting or washing the wool. As most of the persons attacked died in a very few days having been in apparently good health up to possibly a few hours of death it is no wonder that great consternation was caused in the town.

A Local Government Board enquiry was instituted & Mr. Spear came down to Bradford to make a report. Pathological material was sent up to London to Prof. Greenfield, at that time Superintendent of the Brown Institution, & his most able research was embodied in the Local Government Board for 1881. In it he clearly demonstrated the cause of the disease - viz the B. Anthracis. I may mention that Mr. Spear while here unfortunately became involved & had a malignant pustule; happily he recovered.

After mature consideration between employers, employed & Sanitary Committee the Town Council adopted a
in 1884

set of rules, which were supposed to be enforced in all establishments where dangerous works were opened, sorted or otherwise manipulated, but these rules, not having Government authority, were not so strictly enforced as they ought to have been.

A recommendation that wool-sorting should be certified as a dangerous trade was made last year by a Departmental Committee and it was so certified accordingly. Special rules were at once prepared, a copy of which I submit on page 62.

These rules can now be rigidly enforced by the Factory Inspectors, which is a distinct advantage but, as I shall proceed to show when speaking of preventive measures they are by no means so good as those which we have had for the past 13 years.

In cattle several outbreaks of anthrax have been reported to have occurred near Bradford in recent years. On referring to the annual report of the Board of Agriculture for 1895 I find that the number of outbreaks of anthrax in the West Riding of Yorkshire was 38
East Riding 8 + North Riding 5.
It is very probable that the living
virus of foreign origin by washing of
infective material is discharged
into the sewers & streams, or the dust
is conveyed by the wind to the
pastures & thus infects the cattle
& other domestic animals. (There is
a very instructive map showing the
number of outbreaks in 1892 in Dr.
Bell's article on Anthrax in Allbutt's
System of Medicine Vol II, page 531.)

Statistics. There can be very little
doubt that there have been very many
fatal cases of Anthrax in Bradford
never made known at all, simply
because — in the past — many
doctors, not recognising the disease,
certified death to have occurred
from other causes. Furthermore
there is no little doubt that hundreds
of men have contracted the disease
but have survived it — I refer more
especially to Cutaneous Anthrax
these of course are never mentioned
in any returns of the number of cases.
There are thus no figures upon which
any extended calculations can be
based, however in the subjunc't table
are all the deaths which have occurred in the borough since the regulations of 1884 came into operation. (I have not got the figures for the surrounding districts. The great diminution in the number of deaths may have been due partly to the precautions which have been adopted by the employers here when dangerous materials are used, also to the greater care which is now taken to exclude "fallen fleeces" from the tales when they are made up in foreign countries, and also to the absence of epidemics in the countries where the majority of other worsted is grown.

However, that may be, since the adoption of the 1884 regulations the cases have lessened very considerably. Although, since the disease is not notifiable, it is impossible to say how many non-fatal cases really have been, I after making allowance for cases certified under other causes, such as "Bronchitis," "Pneumonia," "Enteritis," etc., the following figures speak for themselves.

In the 10 months from November 1879 to September 1880 there were in Bradford...
In the district among wool-combers 9 cases of malignant pustule with 2 deaths and 23 cases of internal anthrax with 19 deaths (this shows, in passing, the much greater mortality from internal as compared with external anthrax). Since 1883 the deaths are as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Men</th>
<th>Women</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1884</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>1885</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>1886</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>1887</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>1888</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1896</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

For these figures I am indebted to Dr. Evans M. O. H. for Bradford.

Aetiology. Thanks in great measure to the researches of Prof. Greenfield, published in the Local Government Board's report for 1881, there is no doubt what
even that the Bacillus Anthracis or its spores is the cause of this disease. It is, as a rule, directly communicated from the diseased or dead animals to man. It is acquired by the animal generally in its food. The vegetation in the fields or meadows where the animals feed is rendered poisonous by anthrax spores having been deposited in the excreta of diseased animals, or by streams conveying the results of washing of diseased wool, hides etc., as has happened in this district, or by the bacilli from buried diseased carcasses, as Pasteur has shown, being carried to the surface by earthworms.

In man the disease is produced into the system in three different ways.

I. Through some defect of the epidermis in which case the result is Cutaneous Anthrax or Malignant Pustule.

II. By the inhalation of the bacilli or their spores, when we get the Pulmonary form or true Woolsorter's Disease.

III. By the eating the flesh of diseased animals, the bacilli or their
spores not having been destroyed by cooking. The poison is readily attacked by the gastric juice and should not escape the cooking. This form of the disease is intestinal Anthrax and is rare. I have never seen a case.

In an outbreak of typhoid fever among cattle at Warrington the cattle were slaughtered, sold & eaten with a single case of Anthrax was reported. Allowing for the disease not being recognised as Anthrax, the peculiarity of an illness by which a large number of people were attacked with acute gastro-enteritis, in many cases ending fatally, would surely have been sufficient to excite attention.

The cooking had apparently been sufficient to destroy the Bacilli and their spores. The Exciting or Proximate cause being the introduction of the Anthrax virus into the system by means of the skin, the lungs or the alimentary tract, it will be of great interest to see if all men are, at all times, equally liable to contract the disease.

Predisposing or Remote Causes.

Under certain conditions a man is rendered more liable to contract the
disease than under other environments or in conditions of disease. Anything which depresses vital activity whereby the organism is rendered less capable of resisting the influence of the poison. The presence of nitrogenous matter in a decomposing or readily decomposable state affords the best possible preparation for the development of the bacilli, by the contamination of the blood current by the accumulation of waste products.

The following are I think the chief predisposing causes which it will be necessary to consider:

1. Occupation
2. Intemperance
3. Air (foul), overcrowding
4. Diet, unsuitable or wholesome food
5. Starvation and loss of blood
6. Excessive exertion (fatigue), bodily or mental
7. Bad water
8. Exposure to heat, cold, and moisture

1. Occupation. Those persons exposed to the inhalation of dust containing anthrax spores or who have to handle wool, hair, hides or other parts of diseased animals.
m uch greater risk of contracting the disease than those not so exposed. I think that the constant breathing of the fine hairs in the case of work-sweaters causes chronic disease of the bronchial or pulmonary tissues thereby rendering the vitality of the person less able to resist infection. Thus, briefly, overexertion is a cause of anthrax.

2. Intemperance. The habitual presence of alcohol in the blood—current undoubtedly diminishes the oxidation of the waste products and thus their accumulation in the system is brought about. Foul air and overworking. I should like to say here that, according to Dr. G. S. Fris W. Woodhead, experiments made recently in America indicate that animals to which alcohol had been given were more easily invaded by the micro-organisms which produced suppuration and anthrax than animals to which alcohol had not been given.

3. Foul air and overworking cause accumulation within the body of nitrogenous effete matter by (1) reducing the quantity of Carbonic acid get rid of by expiration, and (2) by diminishing the normal oxidation after which they should be excreted by the skin or the kidneys.
It diet—unsuitable & unwholesome. Experiments made by Hanksin show that rats, which are naturally unsusceptible, fed on sour-milk & bread become susceptible. We do not know enough about any particular food which renders man more liable, but a pure meat diet increases the insusceptibility of rats.

5. Starvation. Pigeons are naturally insusceptible to Antitoxin but according to Canaldis & Murganze (Fortschr. d. med. 1892) Starvation renders them very susceptibel. They die if the starvation is only commenced after the inoculation, or if it is commenced a few days before they continue after the inoculation. If, however, they are fed after inoculation they survived. Hens are also naturally insusceptible but become susceptible if starved. Many animals naturally refractory can be made susceptibles by not allowing them any water.

Loss of blood acts in the same way as starvation, susceptibility is greatly increased by depriving an animal of a quantity of blood. The resisting power is much diminished.

6. Fatigue is able to remove the immunity.
If animals, so that it is quite reasonable to suppose that it will render man more susceptible to infection.

Chattoine & Roger have made experiments (Gasemine Med. 1890, II, 2) which show that the unsusceptible white rat becomes susceptible if thoroughly fatigued by making it work a treadmill in its cage.

Bad water might be included under the head of unsuitable food.

8. Exposure to heat, cold or moisture.

As I have already said the hen is naturally immune but if it is immersed in water or its temperature reduced by antipyretics it loses its immunity. In the same way if frogs are kept at an anaesthetic temperature (25° - 35°C) they become very susceptible — naturally. I should say they are not so.

This subject has been worked out by Pasteur, Retzius, Kjer, Ferri, Falasco, and others.

Thus, I have no doubt whatever that workers in work are rendered far more susceptible to infection by the 13. Anthracosis. If they have insufficient food, bad food, an excess of alcohol, or suffer from fatigue or exposure.
Incubation.

I. External or Malignant Pustule.
Incubation generally occurs through a scratch or abrasion or some exposed part of the body — face, neck, hand or arms, although in one of my cases (page 57, case III) inoculation took place on the leg, the foot getting down the trousers. The time between inoculation and the appearance of the small red pimple which rapidly becomes the pustule varies from a few hours to several days, or in some cases it has even been weeks.

II. Internal. The period of incubation varies from a few hours to several days, the usual time being 36 to 48 hours.

Symptoms

I. Malignant Pustule
(a) Local. The first thing the patient notices is that the part inoculated is very irritable, a small red papule then quickly appears which soon becomes vesiculated. The vesicle bursts to a thin serum fluid is discharged. The base of the vesicle now forms the
characteristic brownish or black eschar (avascular, a cool) The surrounding parts become red, swollen, hard, forming a prominence from ½ to 2 inches or more in diameter. This prominence is usually elevated ⅛ inch above the healthy skin around. The central depression is about 1/20 inch below the level of the adjacent ring of vesicles. Around the black eschar a ring of small vesicles is often seen. These contain serum.

The neighbouring lymphatic glands are frequently enlarged and tender, but this may be in a great measure concealed by the surrounding edema of the subcutaneous tissues.

There is often very marked edema for a considerable distance around the jetuline, in the case of Hammond (page 58) it reached to midway between the sternum & umbilicus.

It is often very surprising how rapidly this edema disappears after the jetuline has been excised. There is little or no pain in it around. The eschar, with a slight sense of discomfort being frequently all that is felt. The attached sketch of the jetuline excise
(S). General. The patient frequently continues at work for some days after the appearance of the papule. He then complains of feeling ill, he is feeble and the prostration is often very great. In some cases the nervous symptoms are very severe. The temperature is often high but sometimes falls before death. Dyspnea is easily excited and there is a feeling of constriction of the chest. As a rule death is caused by sudden syncope, or edema glottidis may cause it when the papule is on the neck. Death usually occurs within 3 or 6 days from the onset of acute constitutional infection, being preceded by delirium in some cases.

II. Internal.
(a) Pulmonary Anthrax.
The first thing noticed by the patient as a rule is a sense of great weakness.
At the very commencement of the illness he feels "pretty well" when sitting well supported in a chair or lying down, but get him to walk round the table or across the room the feeling of utter and complete exhaustion is very great. It is this tired feeling, the blue look of his nails which causes him to seek medical advice in many cases. There is nearly always a feeling of constriction about the chest with difficult and laboured breathing. The physical signs are slight there is very little cough and often no expectoration at all. A few rhonchi and rales are sometimes heard over the lungs. The sputum sometimes contains blood.

As a rule the pulse is weak and rapid. Toward the end it becomes markedly irregular. Heart sounds become weaker and weaker as the end approaches. Cyanosis becomes very marked as the heart fails.

Vomiting and diarrhoea sometimes occur. In one case treated in the Bradford Infirmary in 1888 the temperature rose to 110° at death. This is unusual.
as the T\textdegree, although always considerably higher in the rectum than is the cutaneous temperature, seldom reaches more than 102\textdegree F as the case approaches a fatal termination.

According to Dr Bell the duration of this form of Anthrax varies from 17 hours to 9 or 10 days. (The following table is from his article in Allbutt's Medicine Vol II page 545.)

<table>
<thead>
<tr>
<th>Days</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cases</td>
<td>3</td>
<td>15</td>
<td>18</td>
<td>15</td>
<td>7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

10 days | Over 10 days | Total

4 | 2 | 6

(b) Intestinal Anthrax

This form is rare. The temperature is not so high as in the Pulmonary form. There is vomiting, abdominal pain, diarrhea, and blood is often present in the faces. There is great prostration, cyanosis and collapse. When death occurs it is generally in from one to three days.
Diagnosis

I. Malignant Pustule

Reliance has to be placed upon the following points:

1. Occupation. The exposure of the patient to contagion.
2. The character of the pustule. These are very distinctive when the vesicular stage is reached.
3. The microscopic examination of the fluid for anthrax bacilli.
4. The inoculation of white mice, rabbits or guinea pigs with a drop of serum. If the serum contain the bacilli, the animal will die in two or three days. B. Anthracis will be found in great numbers in its blood & internal organs.

Differential Diagnosis:

1. From Boil or Carbuncle, which are painful & soon suppurate.
2. Knots. By the history, the greater rapidity of development, the severe constitutional symptoms of the small amount of malignant pustule.
3. Erysipelas & cellulitis. By the absence of pain & the microscopic examination of the serum. Also by the peculiar pallor & the tendency to the formation of cyanotic
patches.
II. Internal Anthrax.

The following points must be taken into consideration in making a diagnosis of internal anthrax:

1. The exposure of the patient to contagion.
2. The peculiar and sudden prostration of the tendency to a cyanotic condition for which the physical signs do not account.
3. Microscopic examination of the blood.
4. Inoculation of animals with blood from patient.

The following are the chief diseases which internal anthrax is likely to be mistaken.

1. Pulmonary form
   (a) Pleurisy
   (b) Acute pneumonia
2. Intestinal form
   (a) Irritant poisoning:
      (i) Enteritis
      (ii) Typhoid fever
   (b) Acute enteritis
   (c) Dysentery
   (d) Other
Prognosis.

It is impossible to give anything like a mortality table with regard to malignant fistula; as those cases which recover without treatment or those which recover without treatment are not kept account of in any way. The only case of external anthrax terminating fatally within my own personal experience was that of Martha Taylor (Case 1 page 43). The prognosis therefore is very favourable. There may be a great amount of oedema to get the patient make a good recovery.

The position of the fistula of course has a great effect on the prognosis, the most dangerous site is in the neck, as the risk of oedema glottidis is then very considerable.

A high temperature is more favourable than one subnormal.

In internal anthrax the prognosis is very grave.

In the intestinal form, according to Dr. Bell, no case demonstrated during life to be intestinal anthrax has ended
Pathology

Under this head I propose to give

1. A very short account of the
   Anthrax Bacillus, the essential
   feature of this disease
   2. The Pathological Anatomy
   3. The Microscopic Anatomy

The Bacillus Anthracis consists
of a well-defined, short, apparently
homogeneous cylindrical rod. This
straight or may be slightly curved
is considerably longer than the
diameter of a blood corpuscule, the
length varying from 5 - 20 mm.
the breadth from 1.25 to 1.5 mm.
They are best stained by Grant's
method, viz. a double stain of
Eosine & Methylene Blue.
Multiplication takes place by the
rods elongating & dividing & spores are
produced within them. The spores
subsequently become free & in turn
reproduce the rods. These spores
have great vitality & resist considerable
changes of temperature. They can live
for a number of years in a dry condition it are therefore very difficult to effectually deal with.

The rods may under cultivation become filaments of great length and become entangled into one netted mass. This is well seen by the cultivation shown on slide #. The bacilli are very well seen in specimens X3, 649.

II. Pathological Anatomy (Vide P.M. notes - page 144.)

1. Local. The skin around the eschar and the tissues below it are infiltrated with fibrous exudation. The central parts of the black eschar are dried up to a toughish substance. The pus does not undergo suppuration, not a single drop is found. Hands in the neighbourhood are swollen and sometimes ecchymosed. Very numerous anthrac bacilli with their spores are found on examining some of the exudation with the microscope. Small patches of ecchymosis are found in the deeper layers of the corium and sometimes in the subjacent muscles.
2. General

(a) External changes. Rigor mortis appears soon & disappears speedily. Cyanosis is well marked & the lividity is very apparent in the superior parts of the body, not merely in the most dependent. Petechiae are sometimes seen, generally on the chest & abdomen. The face, neck & upper part of the chest are often emphysematous, due to very rapid decomposition.

(b) Internal changes. Ecchymoses are found in the muscles, in the heart, in the subserous & submucous tissues & in other parts. They vary in size considerably. The blood is uncoagulated & darker in colour than normal.

Serous exudation is commonly found in the cellular tissue of the neck & in the mediastinum. The lungs are full of dark-coloured blood & are frequently edematous. The mucous membrane of the trachea & bronchi is congested.

The cervical & bronchial glands are swollen & the pleural cavities contain fluid.

In death from pulmonary asthma

The death from pulmonary asthma
The abdominal viscera sometimes are apparently normal.

In the gastro-intestinal form gelatinous evacuation often short-stomach is found in the mesentry in other situations. The peritoneal cavity contains serum, which may be in considerable amount. The mucous membranes & submucous tissues of the stomach & intestines are congested & swollen. There are many patches of extravasated blood of varying size under the submucous & subserous coverings of the various organs.

The liver is often engorged with blood & sometimes shows small hemorhages. The kidneys are swollen & congested. The spleen is not always enlarged, but as a rule it is. It is engorged with black, purty blood & is very friable.

The mesenteric & lumbar glands are generally enlarged.

To quote from Dr. Bell's article in Allbutt's Medicine - page 548: "The characteristic changes are: (1) The discoloration of the skin: from this alone in many cases the cause of death may be surmised. In some cases, however, it is not decid-
edly marked.

(2) The solstitial oedema of
the cellular tissue in various parts of
the body: particularly in the anterior
mediastinum, around the pharynx,
the trachea, the base of the heart; in the
mesentery, the omentum, the adipose
tissue around the kidneys.

(3) The extravasations of
blood: which may be extensive
in the chest, the abdomen, the head
in the same patient; or in only one
of these places; with innumerable
smaller hemorrhagic areas in any
organ or tissue in any part of the
body.

(4) The extensive serous
effusions into the pleura, pericardium,
and peritoneum.

III. Microscopic Anatomy.

For an exact knowledge of the micro-
scopic anatomy of Anthrax we are
greatly indebted to Prof. Greenfield's
Report issued by the Local Government
Board in 1881.

To illustrate some points I am
submitting micro preparations of Anthrax.
Section of Malignant Pustule

Stained with India

Bacilli: 

Blue

25 micrometers.
1. Shows the structure of the poch. The bacilli are scarcely stained; however. (From Case V, page 58.)
2. Shows the pus plate in an early stage of formation; its structure is also very well seen. (From Case V, page 58.)
3. In this section the Bacilli are seen in large numbers. (It is from Case II, page 46.)
4. In Bacilli are seen in this section of malignant Pustule.
5. The Bacilli are seen—The pleura.
6. Vertical oblique section through the pleura. Shows the Bacilli very well.
7. Also a section through the pleura.
9. Section of Lung, showing the Bacilli.

Stained by Gram's method. Furnished in Canuda Balcania.
Part of specimen, treated slightly with potassium solution. Actual field (secretion from straw-colored vesicle in which fragments of anthracite were definitely made.) Drawn actual size obj 15 × oc. 2 Zeiss X 25.

(from Hammar), Case VI, page 58)
CHARBON BRONCHO-PULMONAIRE

I  Ganglion bronchique. Obs. V
II  Bronche. Obs. V
For these drawings I am indebted to Dr. S. Forge, but from whose paper in the Archives de Médecine Experimentale they are taken. The first one shows the Bacilli in a Bronchial Flum and the second in Bronchitis.
Preventive Measures.
This I consider to be almost the most important part of my subject and one in which I have taken a great interest.

The prevention of Anthrax among the wool sorters of Bradford is due almost entirely to the measures introduced locally in 1884. I have already alluded to the greatly diminished mortality since that year. The fatal cases in all, up to date, having only numbered 15. While I was one of the Resident Surgeons in the Bradford Infirmary from August 1884 to June 1889 it was my duty to attend the Coroner’s Inquests on the cases dying in Hospital & I must say that in the majority of cases it was due to some infringement of the rules either on the part of employers or employed that infection took place. It is a very unfortunate fact that the Rules were not issued by the Home Office & that therefore the Factory Inspectors had not the same power to rigidly enforce them as they had been.
A few months ago a set of Regulations was issued by the Home Office for the inspection of wool, in my opinion, they are so much inferior to our local Rules which of course they supersede that I should like to devote a little space to their consideration. I have submitted what I believe to be some improvements on them.

(A copy of the New Regulations will be found on pp. 62–66.) Before considering the Rules I will state what are the leading points to be attended to in the prevention of Anthrax — I refer only to the disease as seen among wool-workers. I leave out of consideration, lambs' hair-workers to among whom I have had no experience.

When possible the carcasses, hides, or affected animals should be destroyed and not sent to this country at all; however, as we cannot prevent them coming we should very thoroughly disinfect all dangerous wool. The best way to disinfect is to heat it in steamers up to 230° F. This temperature will in a few hours time effectually
destroy all the bacilli and their spores. We know that the lower the quality of woold the more likely it is to contain material from dead animals and therefore to be more dangerous. Dangerous woold should be sorted while damp, after having been well washed in hot soap water. The woold which does not undergo the washing process should be sorted over boards in which there are holes through which the dust is drawn (removed) away to be subsequently burnt.

When the Factory Act of 1895 was passed, woold-sorting was scheduled as a dangerous trade. The sorters thought that their condition was going to be improved; these new regulations however instead, as I have said, of being an improvement are distinctly retrogressive. The present condition in the very worst places in Bradford the district was better than the new regulations demand. The Home Office might with advantage adopt the rules previously in operation...
to make them compulsory instead of optional. There are certain difficulties with regard to getting people to adopt optional rules. The old rules stated that various classes of material should be washed if damaged, that the rooms should be heated in winter, and that bags should be picked clean and not brushed. All these provisions are omitted from the new regulations. Mr. Beaumont, M. T. M. Superintendant Inspector of factories, has made tests of the highest and lowest velocity at the different works in the district. The results of the tests at the works of 14 firms are as follows:

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<th>Minimum</th>
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<td>11</td>
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Instead of the average of these figures, & the minimum being made to accord with them an entirely different course has been adopted. Taking the worst strengths of these 14 firms the average is 787 feet per minute & taking the best average is 1359 & the two together give an average of 1072, yet the proposed figure is 500. This velocity is worse than at the worst board at the worst place in Bradford District according to Wm Beamont's own figures. But to obtain the figures I have given, visits had not been paid to the best firms. There were results obtained from two other firms which were far better. In one instance a test which the secretary of the National Union of Worshippers made gave a maximum draught of 1900 ft. per min. at minimum of 1260 ft. Tests at another place showed an average velocity of 2100 ft. per min. Of the masters found that the regulations permitted them to reduce the revolutions of the fans. Some of them might possibly take advantage of it. In Rule 70 it is stated that there should be a pipe connecting the sorting-board with the main at least.
4 inches in diameter. If the regulations are enforced no one will be allowed to cover that pipe up; it will have to be entirely exposed. In a place where there are 60, 70, or 80 sorters every board has a quick pipe. The sorter nearest the fan would have a velocity at his board of 3000 ft. per minute in order that the man farthest away should have a velocity of 300 ft. The former would be fortunate if he were not pulled down the hole of the latter if he were not smothered with dust. The diameter of the board pipe should be regulated in proportion to the distance from the fan.

(The down-draught should be registered by a 14 inch Negretti & Zambra's anemometer.)

One from in Bradford has a fan which draws 1360 ft. per min. at the worst board they have in the place. At 1900 ft. at the best. Any fan that does not create a sufficient down-draught to keep the dust below the men's shoulders or heads when sorting is not doing its work properly. One essential point is that the fan shall not only remove a
large volume of air but also be able to overcome a fair amount of resistance, or its efficiency will be over a very limited area and these will be a very great difference between the maximum and minimum readings. A fan with straight blades is not suitable for the work in question, as, with the least resistance, the air flies off the end of the blade instead of being propelled forwards. I am told that the best type of fan for dealing with volume and pressure is of the Blackman construction i.e., having blades curved at the periphery. Free inlets and outlets for fans should be provided or satisfactory results will not be obtained. I am also assured that the pressure fan is altogether useless for removing the dust. One of the Blackman fans is installed for removing dust from the sorting boards at Messrs W. F. Flinn & Co's works at Bursley in Wharfedale and the following are the results: The fan is driven at 580 revolutions per minute by an electric motor and gets its air supply through 19 openings in the sorting board.
also ventilates another room through a pipe 2½ in. in diameter.
The average velocity of the air through the openings on the sorting-tables is 
2200 ft. per min. At the nearest point, 10 ft. from the fan the velocity is 
2340 ft. per min. At 160 ft. away there is a velocity of 2160 ft. per min.
At the velocity 200 ft. away from the fan is 2100 ft. per min. Hence over 
a length of 200 ft. there is only a difference of 140 ft. velocity per 
minute between the highest and the lowest readings.

The draught should, as far as is possible, be equalised as has been 
done at the works just mentioned if the room be not warmer 
the men complain of cold and 
cover up the holes. A draught of 2 x 3, 000 ft is far more than 
is required. 900 ft. is quite sufficient to keep the dust down.

I would therefore suggest the following amendments to the New Rules: —
1. That the down-draught at each 
sorting-board be a minimum 
of 900 ft. per minute (instead of 300 ft.)
2. That the connection to each sorting—
board shall be made by means of a circular bowl, 10 in wide at the top, and sloping down to 3 in at the bottom where it joins the main pipe.

3. That all sorting-rooms be kept comfortably warm, and that a thermometer be hung in every room. I would suggest 60° F as a suitable temperature.

4. That all bags be picked clean, and not brushed.

5. Wool be washed if damaged, or if likely to be injured by the washing it should be thoroughly disinfected in the steamer at a temp. of 230° F.

Treatment:

I. Malignant Pustule.

The object to be aimed at in the treatment of this condition is the early and thorough destruction of the eschar. This is best obtained by means of free incision with the knife, although the actual cautery has proved in many countries a most efficient instrument.
The infiltrated, indurated part should be excised freely (see sketch page 16) under ether where the patient's state will permit. If the cut surface does not look healthy, the suspicious points may be touched with the thermo-cautery or with some caustic such as zinc chloride, fuming nitric acid, liq.
unifid crystals of Carbolic acid, or Potassa fissa. During the operation the wound should be sprayed with a solution of Carbolic acid (1 in 20). All bleeding should be carefully stopped before the wound is closed. The dressing should consist of carbonised lint or an ice-bag be placed over it for 24 hours.

It is a good plan to inject a few minutes — say 10 or 15 — of 1 in 50 Carbolic acid at various points around the puncture, this with the idea of checking the absorption of the poison into the system.

If the oedema is great it does not readily disappear, a few incisions into it may be advisable. Sometimes life is threatened from oedema of the larynx, in which laryngotomy must be done.
II. Internal Anthrax.
As a rule this disease runs such a rapid course that there is but little time for any treatment to be adopted with any hope of success. The first thing necessary is that the patient be kept very quiet in bed & stimulants given freely. These are best given in the form of Ammonia & Alcohol—preferably Brandy.
Food should be highly nutritious & sold. Therefore the largely composed of beef-tea, strong soups, milk & eggs.
With the idea of destroying the bacilli, antiseptic inhalations have been suggested, such as Carbolic Acid (1 in 20) or Mercuroic Bromide (1 in 500). Dr. Bell thinks that more good will be done by the intravenous injection of a sterilised solution of Permanganate of Potassium or of Hypo-sulphite of Sodium. Quinine in large doses is also of great service.
In the Pulmonary form stimulants expectorants, such as Senega with Ammonia, must be given.
As there is sometimes a large amount of fluid in the pleural sacs this should be withdrawn.

Sleeplessness must be treated by morphia given hypodermically if the condition of the patient will permit.

In the intestinal form Salol or β-napththol should be given as germicides. The diarrhoea should be treated on the usual lines. With regard to the anti-toxin treatment of Anthrax I have had no experience though I have no doubt that some day it will be of the greatest possible value.

Marchaux (Ann L'Inst Pasteur) gives an account of his preliminary researches into the anthrax anti-toxin. He obtains his serum from the sheep, which has, however, to be very highly immunised to provide serum which is efficacious in curing the disease.
Cases

I

Martha Taylor, age 44 yrs., residing at 10 Broadbent St., Bradford.

History

Patient had been working in China and Van woods. Two days before admission to infirmary fell ill, took a purgative in the morning, went to work in the afternoon, but felt very weak. On the following day she noticed a pustule on the back of the neck.

On admission. Patient said she felt quite well but had no pain. The pulse was 110, very weak and somewhat irregular.

On the left side of neck below the occipital protuberance there was an ulcer covered with a grey slough, around the ulcer was a zone of vesicles with thickened walls so that on pricking them very little fluid exuded. There was very little hardness around it, no glandular enlargement could be detected. No crepitations were heard over the chest. There was no impairment of the percussion note.

Treatment. A crucial incision was
made through the fistula & the times around it freely excised. As the slough extended along the lines of the lymphatics as black lines forwards these were followed & freely removed until the surface of the wound presented a healthy appearance.

Progress. Patient had a restless night, sleeping badly. At 5 am she had marked dyspnoea but this passed off in a short time. At 8–10 am she seemed worse, the pulse was very feeble & she complained of soreness of the throat. Marked cyanosis of face & arms. Had a great desire to get up & go to stool.
At 10–30 she said she felt quite well and wished to get up & go to stool. Pulse hardly to be felt at the wrist. Cyanosis of both arms and face well marked.

Post-Mortem Examination 10½ hours after death.

External appearances. rigor mortis well marked, nails of fingers slightly discoloured. Pained expression on face. Wound 2½ in. long by 1¼ broad on left side of neck where a malignant fistula had been excised.
On opening the abdomen some fluid was found in the peritoneal cavity, and a coil of small intestine was somewhat infected. There was no fluid found in pleural cavities, the small quantity at the right side having flowed in from the abdomen. There was a small quantity of fluid in the pericardial sac although not much more than usual.

No bronchial or other glands could be felt to be enlarged. A crepitation mass was found on left bronchus. Some ecchymoses at commencement of aorta. The chambers of the heart all appeared to be quite normal. Intestines ecchymosed and inflamed in numerous patches. Short lengths of intestine were found alternately dilated and contracted. The attached margins of the bowel were the most inflamed. Lines of vessels running from intestines to mesenteric glands in places. Ecchymoses in mesenteric glands, indicating extreme adenitis. A quantity of light yellow gelatinous material was found in the mesentery. A dilated coil of the inflamed intestine was opened, an ecchymosed and ulcerated
interior, the ulcer having ragged, everted edges & irregular, slightly granular & inflamed floor.

Spleen was somewhat enlarged & on section was found to be soft & of a dark crimson colour.

Numerous Anthrax Bacilli found in blood removed from the pustule before excision & in the vesicle fluids removed from the body p.m.

II.

Fred Pollard, at 142, 10th Royal St.


History: Patient came complaining of a "soil" on forehead. He is a lodger at 10 Back Royal Street, at which address a youth died from Malignant pustule on the forehead five weeks ago. He works at Messrs Root, Benn & Co. a firm using only foreign wool & next door to Messrs. Rouse & Co. who use no foreign wool.
The patient was who died. After the fatal case bedding + clothes were stowed but the house was not otherwise disinfected. Patient has been feeling "out of sorts" for two weeks + has complained of the amount of dust in his work. He works at right. He had no noticeable abrasion on the skin.

On 29th inst. (two days before admission) at 3 p.m. he felt a small "heat lump" on his forehead. Next day it was a little larger but not bigger than this.

On waking this morning (May 31st) the lump was much larger than a black centre with an area of surrounding redness. It has given no pain. Patient vomited at midnight yesterday (50₂₄) but had previously taken some beer. No purging.

On admission. On the forehead near the middle line + extending more to the right than left side is a pustule with a small depressed dark brown centre surrounded by an elevated ring of commencing vesicles of a pale yellow colour. This again is surrounded by an elevated area of redness this

slightly edematous ring about 1/2

inch.
On left side of forehead some three erythematous patches & some commencing oedema around them are seen. The oedema is at present very slight.

Temp. 99.4° Pulse 84. He feels quite well & looks so. Has pain behind angle of jaw on both sides but worse so on the right side. Two glands are felt here but there is some tenderness on pressure.

Treatment. Under a mixture of Ether & Chloroform the pustule was excised. The incision keeping clear of the erythematous area, bleeding stopped by force pressure & pressure of pads. Exposed surface touched with liquid Carbolic acid. Gauze bandage with wool, & pressure applied by a bandage.

Progress. June 1st. Urine 36. 37. 1024 acid, no albumen, no sugar. Had a comfortable night.

June 2nd. 11-40. Two hours ago redness over the right zygomatic arch noticed. There had been swelling of face in the night report. Half an hour ago a drop of serum was seen in the middle of this swelling. Now an elevated area of redness with tenderness at angle of jaw is noticed.
Midnight. A.C. Carbol. 30 m.  
4 ½ hrs. 22.29.7. 

Orecin Sulf. cr. [m]. 
4 ½ hrs.

In 1/2 A.C. Carbol. (2% solution) injected into centre of brown area on r. cheek below the surface.

Perchloride of mercury fomentation 1 in 500 to brown area on r. cheek.

June 3 ½. Swelling has increased in size. Pulse 60. Feeble.

June 4 ½. Brandy given during the night. The pulse being slow—50 to 60 per min. + feeble. 1 in 40 Carbolic acid sol. injected at site of brown area on r. cheek.

11 a.m. Pulse 72. Was feeling chilly + feet clammy. Not pale, no right, no vomiting. Slight itching on left males process in corresponding position to the place on right side. A ring of vesicles just forming here. No elevation, no redness inside or outside the pain ring.

On right side of nose some redness with indefinite vesicles. Less tenderness at angle of jaw.

Pustule on cheek looks no more advanced. Numerous members of Anthrax bacill.
found in sections of the original pus
ule. None were found in the serum
taken from the cheek.
Perchloride fermentations kept on.
Bacilli in section ran up to edge of
margin of healthy tissue.
June 6th. The red patches on
right cheek are gone.
June 7th. Slight epigastric pain
this morning. Temperature
subnormal. Has no special discomfort.
On right cheek central purplish area
triangular in form & measuring
1/2 in. by 1 in. with an irregular line
of small pustules over surface,
swelling around this area distinctly
subsiding.
The temperature on admission was
99.4° it rose to 100.6° in the evening
of June 1st, became subnormal
in the evening of the following day &
remained so throughout the patient’s
stay in hospital.

(Section V 3 is from this case)

Henry Sheevesmith, aged 26, Millhall.
Address 57, Sunny St. Bradford.
Patrick works at Messrs Rolt, Benn & Co. Valley Road, West Merchants. He works at night and in the same room as Pollard who came in 9 days ago with a malignant pustule on forehead. He is now recovering (Case II)

He had to carry heaps of wood to Pollard. The dust gets into the upper part of his trousers two down his legs. He had no abrasion of the skin on legs, but on Saturday June 6th he felt an itching in left leg just above the knee. Next morning a little pimple came up. It has gradually grown since then. He felt quite well up to this morning, but then felt chilly and shivered somewhat. He felt acting pains in all his bones. No vomiting or diarrhoea.

On admission. A typical malignant pustule size of 6 situate about 2" above tops of head of fibula on the outer side of left thigh. Around it is considerable induration to a diameter of 2". No enlarged glands in groin.

T° 99.2. General condition apparently normal.

Treatment. An hour & a half after admission under ether & chloroform a circular incision was made well outside
indurated ring down to the fascia & the flap of skin. Beating the pustule dissected readily off this. The pustule was at first drawn upon by catch forceps & some serum oozed out from this pressure & afterward from the forceps tearing away. This serum was carefully wiped away from entering the incision. Wound had a diameter of 2 1/2 inches but the edges were readily brought together with sutures. Drainage tube put in. Some bleeding points were tied. Wound left dry. Back splint.

11 1/2 Tube left in a little tension on some of the stitches. Otherwise well.
13 1/2 Anthrax Bacilli found in section of pustule.
15 1/2 All but one suture (right) removed. Healing by 1st intention.
16 1/2 Last suture removed.
17 1/4 Wound gaping widely to full extent. 5 sutures inserted.
28 1/4 Wound healed, stitches removed. Strapping to prevent gaping. The temperature chart showed little variation from the normal.
Sam Priestley, at 32, Woolsorter.
Address: 37 Sheridan St. Admitted 16/3/97
Discharged 29/3/97.

History. Six days ago patient noticed a small pimple on the scalp a short distance above the forehead. Three days later this had become a blister & crust, the fluid passing downward towards the forehead. The next day there was a good deal of irritation about the part. Worked this morning until mid-day then gave up not feeling well.

On admission. Well nourished man
On scalp, over situation of coronal suture & on left side of middle line there is a rounded group of vesicles with a bluish purple depression centrally. For about 2 in. from this forward a moist line with some vesicles apparently where the fluid had run down. Around this line & the vesicular ring the skin is reddened & there is marked oedema of forehead on left side. The oedema extending downwards to level of zygoma & over the malar bone.
Some fluid from the vesicles was drained by Gram's method & B. Anthracis found. Treatment: Under E.C. Vesiculating ring & line of vesicles running forward from it surrounded by an incision of the scalp tissues enucleated dissected off the pericranium, leaving a gap about 5" x 3½". Bleeding stopped by forceps & wettte. In X A.C. Carbolic 2% injected through each of six punctures into the subcutaneous scalp immediately around the excised area. Wound dusted with Iodoform & Boric acid (1 in 10) & dressed with Boric lint.

Test: Urine: 3½ hr
17 ¼: Urine sp.gr. 1025 acid, no albumen, no sugar. About 1½" above tip of olecranon on posterior aspect of arm there is an erythematous area 3½" x ½" with central yellowish-white patch almost vesicular, not tender. There are two slightly smaller erythematous areas near. They are not vesicular. 2% Carbolic acid solution injected—about 90 min in all—into each of these three patches.

9 p.m. Chloroform for XX in Dr. Brandt.
18th. Boric acid fomentations to scalf & arm.

22nd. Scalf wound sloughing, exuda much diminished.

25th. Anthracose bacilli were found before operation in the serum of the vesicles. Sections of the pus-tube showed Anthracose Bacilli together with cocci in the tissue.

Section of the skin excoriated by the serum trickly down showed cocci but no anthracose bacilli.

29th. Healing occurring at margins of wound. No general infection.

Dressed with Bals. H. E. Boracic.

Parts over back of elbow now normal.

The temp. The evening following the operation was 99.8, from this it dropped to subnormal & remained so until me in two slight rises above normal while patient was in hospital

V

Fred Wolstenholme, at 33.

Westcombe, address 20 Minst. St.

Admitted Mon. 26/97, Discharged 30/10/97.

History. On the 23rd inst. patient felt a hard lump on his upper arm while
washing himself. He had no wound or injury here. It has never been painful or tender. It was like a blind boil, just red at first. It became red and grew larger. It turned black in the middle in the evening before admission (25\textsuperscript{2}').

The foreman where he works tried to cut it this morning at 6 am. He scratched the skin off, found it hard, he did not cut deep. It did not make it bleed. He then told the patient to go home and take it to let him see it the same evening.

Instead of again going to see the foreman, he was advised by Pollard & Shoesmith (Cases II+III\textsuperscript{2}) two former patients who had had similar pyorrhoea. He was told to come at once to the Infirmary which he did at 12 noon.

Four days before admission (March 22\textsuperscript{5}) he felt as if cold water was running down his back but his teeth did not chatter. He has had no more chilliness since it has had neither diarrhoea nor vomiting — he says that he has felt it feels now, quite well.

His occupation is wood-turning.
work he works among is camel-hair & foreign wool at Roth, Penn & Co's works.

On admission, there is a small hard button-like mass in the skin of the left upper arm, one third from the elbow & on the extensor aspect. It is dark in color & the cuticle has evidently been torn off it. There is a suspicion of blisters forming around it. (The skin seems nodular around the dark center.) Patient seems quite well. Temp. 99. Pulse not enlarged.

Later in the afternoon vesicular ring around the dark center became more distinct.

Treatment. Under E.C. mixture the pustule was excised by a circular incision. Flow of wound dressed over with liquid carbolic acid. Boric acid ointment as dressing.

Section through pustule, deep to depth of about 1/8 in. Knife appears to have cut clear of the deeper part of the pustule. Temperature chart shows nothing very abnormal.
Hammond at 26, Woolcot.
Residence Heston W4, Bradford.

1st Day. Sunday afternoon about 5 o'clock he was walking in the Park when he felt a sting like a goad in the face. He scratched it, it kept irritating it became a little lump like a pea.

Second day. Hard lump with swelling halfway down neck. T 102.6.

Third day. Much worse, throat swollen, could not swallow anything except fluids. T in the morning 103.6. In the afternoon was delirious & semicomatose. T 103.8 Pulse rapid & soft. Typical profuse fluid.

At 10-30 p.m. the prostate was excised. The exposed surface was well rubbed with solid ZnCl₂ & the cavity filled with powdered Boracic acid.

Edema all over chest to point midway between sternum & umbilicus. Slight after a little vomiting.

Fourth day. Waked up and wanted some beer. T 101.8. At 10 a.m. was quite clear & fully conscious. Edema of chest already subsiding. In the evening the edema was less & T 101.2.
Fifth day. Smothing & setting up well.
T 100.5 a.m. T 98.4 p.m. Was practically well.

Sixth day. T 99.0 a.m.
From this time patient was well except for wound, which at the end of six weeks had left an almost linear scar without any depression.

It was from this case that the drawings on p. 16, 28, & 29 were taken of the microscopic preparations No. 1 & 2.
Joseph Wand at 112 Woolsorter
History: Patient had worked at
Ingrow Mills for the last 14 months
and previous to that time he had
been employed for a period of two
years at the works of Messrs E. Wand
& Co., Bradford. For the last 13 years
he had been engaged either by Messrs
Wand or at Ingrow Mills. His work
had been the sorting of worsted half-fosses.
He ceased work at noon and then
appeared to be alright. The same afternoon
(Saturday) he went out with his son.
On rising the following morning (Sunday)
he complained of a pain in his head
and went back to bed. He got up again
about 11% in the afternoon but was
unable to eat. He was unable to sleep
that night but at 6:30 on the Monday
morning he rose with the intention
of going to his work. He was, however,
obliged to return to bed owing to a
severe pain in the chest. He remained
in bed all day on Monday as he
could not bear up owing to dyspnoe.
At this time the patient was not
regard the matter as very serious.
+ as the night was a very wild one. Patient requested that the doctor should not be sent for. He was seen for the first time at 1 o'clock p.m. on the Tuesday. His condition became very serious about 5 p.m. and gradually got worse until his death at 11:55 p.m. On the Sunday the patient expressed the fear that he had caught "Wool-sorter's Disease." A fortnight previously he had in the week before his death he complained to his wife that the work he was on was "fearful dusty" and that he had "got on a fearful mucky tug." He made no complaint about the regulations at the works. The man when seen was in bed and complained of headache, pain in the chest, and shortness of breath. Temp. 100.4, Pulse 84. The patient could talk fairly well and did not seem to be so greatly prostrated as to suggest a fatal illness. Death at 11:55 the same night at post-mortem examination, of which I regret to say I have no notes, revealed undoubted evidence that the man had died from pulmonary anthrax.
New Woollen Sorting
Regulations.

Mr. Whitelegg, the Chief Inspector of Factories, has issued the following new regulations for woollen sorting which have been framed by the Home Office, and which will be applicable to the whole of the United Kingdom.

Duties of Occupiers.

1. Bales of wool or hair shall, whenever opened for the purpose of being sorted, be so opened by men skilled in judging of the quality and condition of the material.

2. All alpaca, pelibuey, East Indian, Cashmere, Persian, and camel-hair shall be opened over a fan, in a room specially set apart for the purpose, separate and distinct from any sorting room.

3. All dam, damaged wool or hair, and fallen fleeces, shall be washed before being sorted; this rule shall apply to the whole of the contents of any bale of wool or hair in which any fallen fleece or damaged material may be found at the time of opening.
1. No alpaca, Cashmere, Persian, Camel-hair, or mohair shall be sorted except in rooms provided with extracting fans, so arranged that each sorting-board shall be independently connected with the extracting shaft by means of an opening not less than four inches across (measured in every direction), in such manner that the dust may be drawn downwards. The draught shall be maintained in constant efficiency, so as to be such that not less than twenty-five cubic feet of air per minute are drawn by the fan from beneath each sorting-board. (Note — A circular opening four inches in diameter with an effective velocity of 300 ft. per minute at the opening will be sufficient for this purpose.) The extracting shaft shall be cleaned out at least once in each week.

5. The dust collected by the fan shall be discharged into properly constructed receptacles. This dust, together with the sweepings from the floors and walls of the sorting-room and from under the sorting-boards, shall be removed...
twice a week if burnt. All pieces of skin, scab, and clippings or "shearings" shall be removed daily from the sorting-rooms, and be disinfected or destroyed.
6. No person having any open cut or sore upon any part of his body shall be allowed to enter.
7. Proper provision shall be made for the keeping of the sorters' clothing and food outside of the sorting-room. No meals shall be allowed to be taken in the sorting-room. During meal hours the windows shall be kept open.
8. No bale-work or hair shall be stored in a sorting-room, nor work of any description unless the same be effectively screened off from the sorting-room. An air-space of at least 1000 cubic feet shall be allowed for each sorter, exclusive of any portion screened off.
9. The floor of the sorting-room shall be thoroughly sprinkled daily with a disinfectant solution, and swept daily after the work is done.
10. The walls and ceilings of the sorting-room shall be linewashed at least
once a year.

11. Requisites for treating scratches and slight wounds shall be kept at hand.

12. Proper & sufficient appliances for washing, including basins, water, soap, nail brushes, and towels, shall be provided in or near the sorting rooms for the use of the sorters.

Duties of Persons Employed.

13. If, on opening a bale of wool or hair, any fallen fleece or damaged material is discovered, the person opening the bale shall report the discovery immediately to the foreman.

14. Every sufferer having an open cut or sore on any part of his body shall immediately report the fact to the foreman.

15. No sufferer shall keep in the sorting-room coats or other articles of clothing beside those he is wearing. Two meals shall be taken in the sorting-room.

16. If the stroak or any sorting-board, or the fan or any other appliance...
necessary to the production of such draught is found to be out of order, the sufferer, or any other person becoming aware of the defect shall report it to the foreman at once.

February 1st 1897.

Note. — Under Section 9, Factory Act, 1891, any person who is bound to observe any special rules, as well as the occupier, is liable to penalties for non-compliance with such special rules.
References.

1. Bell (a) Lancet June 1880
   (b) On Anthrax, in Allbutt’s System of Medicine Vol II
2. Greenfield (a) “Malignant Pustule,” in Dumas Brit. J. of Medicine
   (c) Local Ent. Board Report 1881
4. Lodge Arch. de Mé. EXPERIMENTALE “La Maladie des trempodéline”
5. Martin S. Annual Reports of Local Government Board.
6. Unna Histopathology of the Skin pp. 1455—1460

My thanks are also due to my friends 19½ Bell, Evans, Hume & Kerr,
J Bradfield for much valuable information & advice.