ANTHRAX AND IMPORTED ANIMAL PRODUCTS.

(A RECORD OF TWENTY-ONE CASES IN THE
PORT OF LIVERPOOL.)

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THE continued prevalence of anthrax in Great Britain, especially in industrial centres, ought to awaken increased interest in the subject of preventive measures against this disease. In this connection it may prove useful to record some cases of this well-known disease which have occurred amongst those engaged in handling imported hides, hair, and wool during the past three years. The majority of these occurred in the Port of Liverpool, and chiefly amongst dock labourers.

Anthrax is a disease which has been known in its clinical aspects for a very long time, and is of the widest geographical distribution. Towards the end of the 18th century it seems to have been first recognized on the Continent in the human subject, and is referred to in writings as chiefly affecting those engaged in the trades of tallow-chandlers, horse-hair and wool workers.

Since 1849, when the bacillus was first observed by Pollender, our knowledge of its life history has been greatly extended, and for this we are chiefly indebted to the investigations of Koch: in addition, the well-known researches of Pasteur and other French bacteriologists on the attenuation of the bacillus for the purpose of inoculation against the disease are of epoch-making importance.

In this country the subject of industrial anthrax has been carefully investigated in recent years by Dr. Russell, Mr. Spear, Dr. Legge, and others. The results of their enquiries, and the experience gained from observations extending over a very long period, have proved that the traffic in foreign animal products is a dangerous one for man and animals. The usual precautionary measures as to the disposal of the carcasses of animals which have died of anthrax cannot be assured in such foreign countries as Persia, China, Siberia, and Asia Minor, either from the cases not being diagnosed or from the want of precautionary regulations. As a result, very large numbers of hides and much hair and wool from animals which have died from this disease are imported into this country from different parts of the

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world, and manufactured into various finished articles, such as leather, hair-cloth, carpets, cloths, blankets, rugs, felt, brushes, etc.

As is well known, the spores of this bacillus are extremely resistant to physical and chemical agents ; in addition, countless numbers of them are enclosed in the dried-up blood-clots and serous discharges which saturate such animal products as hides, hair, and wool obtained from animals which have died from this disease.

The methods at present in use for curing hides and skins do not destroy these spores. Much of the colonial and some other wools imported into this country are, as a rule, obtained from animals which have been washed before shearing, and the risks attending the handling of these wools are very small as compared with other varieties of wool and hair, such as mohair and Persian wool, which are imported in a very dirty and dusty condition, and may include fleeces from animals which have died from anthrax.

The dust arising in the sorting and other manipulations of imported animal products is the chief harbour for the spores, and is always to be found in more or less quantity where these operations are carried on. Where much dust is generated, the spores are easily carried into the mouth in breathing or swallowing, but more usually it collects upon the clothing or finds an entrance into the broken skin by a cut or bruise, or a scratched pimple, being deposited there from the air or carried and rubbed in by the dusty fingers or clothing. It would appear also that workmen who have had a recent shave and show numerous small points of raw skin would be suitable subjects for infection. The most frequent sites for the malignant pustule are the uncovered parts of the body, especially the neck and face.

Our knowledge of the epidemiology of this disease is extending, and it can be readily realized by what a variety of channels the spores of this bacillus may be disseminated. It is therefore not a matter of surprise, considering the extreme resistance and inaccessibility of the spores and the constant importation of infected material, that we have not, as yet, been able to stamp out the disease.

Anthrax is a common disease amongst cattle, and is co-extensive with their presence in all parts of the world, but outside Europe our knowledge of the extent of its prevalence is still far from satisfactory ; especially is this the case as regards China, Siberia, Persia, Africa, and South America.

Recent official figures record the fact that about 1,000 cases of anthrax in animals occur annually in Great Britain, but four times as many cases occur in each of the countries, Germany, Italy, and Asiatic Russia. In European Russia and in the Caucasus the number of cases

approximates to no less than 40,000 a year. In these countries, however, it must be remembered, the number of animals is very much larger than in Great Britain. In Africa and South America anthrax also exists, and in India the districts of Burma and Madras seem to be most seriously affected.

A few reports of Consular representatives which have been obtained on outbreaks of this disease in various countries are interesting, and show its wide-spread distribution both in man and animals.

August, 1902 : " In the village of Aksai, province of Astrakhan, at the end of June there were discovered in one family several cases of acute infectious disease, declared by the surgeons to be anthrax. Similar cases of sickness appeared in other houses of the village, and plague was suspected, but a Government bacteriologist was sent, who made clear that the disease was anthrax. The Governor of Astrakhan arrived with a special medical staff, and preventive measures were adopted. The total number of cases was 26, of which 16 ended fatally."

April, 1903 : Consul Bornholdt, of Riga, reports the occurrence of three cases of anthrax amongst the workers in a factory at Libau. The infection was traced to the handling of Siberian sheepskins.

December, 1903 : " In November a disease broke out amongst the inhabitants of the Department of Intibuca, Honduras, and became general over the town of Esperanza ; a large number died. At first the disease was variously diagnosed, but was subsequently proved to be anthrax. Amongst the suggestions made by the advisory committee of local medical men regarding notification, inspection of cattle ranches, and ploughing up infected ground, was one recommending that when a person died from anthrax the body should be buried five feet deep in quicklime, and the clothing and all personal articles burned."

September, 1904 : " An epidemic of anthrax has occurred amongst cattle in Siam, and several persons have died from the disease."

February, 1905 : " In the Government of Viatka (Volga), from February 8th till 17th, 1905, 32 cases of anthrax have been reported."

The term " wool " in the technical sense includes wool and hair of the sheep, goat, mohair (Angora goat), camel, llama, and alpaca. Colonial sheep's wool is not of a dangerous character, and during seven years no case of anthrax has been reported amongst those handling it. The most dangerous are the dusty wools and those containing fallen fleeces (i.e., fleeces of dead animals) amongst them. It has come to light that these fleeces are frequently divided up by those who make up the bales abroad, and that portions are put into bales of good wool,

thus spreading the contamination of anthrax. The wool of these fleeces is dull and lustreless and has lost much of its elasticity; such wool comes chiefly from Asia Minor and Persia.

The following are very dusty wools: Mohair, Persian, Camel-hair, and Cashmere. Mohair is obtained from a species of goat in the neighbourhood of Van in Kurdistan; also from Turkey and the Cape of Good Hope; the wool is long, coarse, and very dirty. Persian wool is a very fine, but very dusty wool. Camel-hair is imported from Russia, Siberia, and China, and Cashmere is obtained from the Thibet goat.

The wool imports into Liverpool are large, and the following table gives the number of bales imported during the years 1903, 1904, and 1905:—

	1903.	1904.	1905.
East Indian	103,564	125,493	114,579
Asia Minor	4,871	3,811	2,535
Egyptian	5,618	6,842	6,514
Turkey (sheep's)	14,379	16,674	13,740
„ (mohair)	69,149	55,614	47,556
African (Morocco)	10	39	—
Spanish	1,867	1,335	1,330
Portuguese	12,350	9,461	8,919
Iceland	4,844	—	336
River Plate	42,642	15,881	29,699
South America (West Coast)—			
Sheep's	33,332	31,886	31,879
Alpaca	29,779	27,369	25,341
Sundries	102,021	78,847	75,906
	*(99,930)	*(69,323)	*(60,384)

Another dangerous animal product is horse-hair; it comes chiefly from European Russia, Siberia, China, Mongolia, and other countries. Russian and Siberian mane- and tail-hair is much cheaper than that from other countries, and therefore much in demand. The hair is collected by agents, who buy it from knackers and others at various country markets. It is sorted out, packed in bags without any cleaning, and sent direct through Riga, Hamburg, or Antwerp, to England. Some Russian hair imported into England comes via Austria, where it has undergone a preliminary cleansing. China white tail-hair comes into this country in a much cleaner condition than the other varieties of horse-hair, from the fact that it has already been washed and partly drawn before it is imported: the danger in handling it is therefore proportionately diminished.

* Persian, Syrian, and Russian, in transit.

As regards cow-hair, the most comes from the large slaughter houses on the River Plate, and is used in making felts, horse-cloths, etc. The usual processes in a hair factory in connection with which infection may arise are the opening of bales and sorting the hair; this is then washed in hot water, soap, and soda; it is then wet-heckled to remove dirt and combings, and then dried. To get mane- and tail-hair into long skeins or tails containing hairs of the same length, it is pulled or drawn, and finally made into bundles or twisted into ropes.

Pigs' bristles and pigs' wool, which is the soft hair from the stomach and sides of the pig, are also amongst the animal products which sometimes convey anthrax, and particularly that coming from Russia. The pig is not a very susceptible animal to this disease, and it has been stated that the disease does not occur in the manipulation of pigs' bristles, but from German experience it seems that it may occur. Pigs' hair is treated in the same way as horse-hair—dyed, washed, dried, and packed in sacks or bales.

The imports of horse-hair, cow-hair and bristles during the year 1905 were as follows :—

There were 509 bales of horse- and cow-hair, each weighing about 6 cwt., imported into Liverpool; they came chiefly from South America (River Plate and Rio Grande), but in smaller quantities from Russia and other countries. There were also imported 5,419 packages of hide-hair, which includes a mixed lot of hair taken from the hides in the preparations for tanning. Hogs' hair and bristles, to the amount of 2,278 bales, each weighing approximately about 4 cwt., were imported from the Western States of America, the West Coast of South America, and the Continent.

Hides are collected by agents, who buy odd lots at markets and fairs held in various countries. They are sent to seaports for transmission to this country. Before shipment they may be sorted according to quality, etc., and a consular or veterinary certificate may be required as to their freedom from disease. This is a safeguard that is required in the case of those imported into the United States, but its value as to the presence of disease is very doubtful.

Foreign hides are cured abroad in many ways, which vary according to the country of origin, and they arrive in this country either as dry or wet salted hides. The curing may be either by drying in the sun—and this is especially the case with African, East Indian, and many South American hides—or the hides may be salted with salt and saltpetre, or put into a brine bath, or cured in solutions containing arsenic or lime. Hides from some parts of the world, e.g., India,

may be soil-cured, i.e., rubbed with soil which contains a large amount of nitre, and dried.

Dry hides are usually folded lengthwise, with the fleshy side outwards, and they may be imported loose or in bales. The smaller skins of sheep and goat are usually sun-dried, but salt and arsenic may also be used. They are packed in bales under pressure, and covered over with canvas coverings. These dry hides are very dusty and hard, and they require much soaking to soften them before they are passed through the tanning processes. Wet hides are cured by being strongly brined with salt solution, and can be stacked in this condition for a considerable time. Finally, for shipment each hide is folded into a small bundle and tied with rope. On arrival at the docks the hides are usually swung up through the hatchway on to the quay and wheeled into the dock sheds, or carried in the labourer's hands, or on his shoulders, and stacked. If not carted off immediately to hide markets and elsewhere, they may remain in sheds for some time.

Frequent re-sales and re-shipments occur, and hides may arrive in Liverpool from France and other Continental countries, although derived from such countries as China and South America.

The annual importation of raw hides into the Port of Liverpool is a very large one. The total import of dry hides and salted hides for 1905 was approximately 850,000. These imports came chiefly from the River Plate, West Coast of South America, Brazils, West Africa, Continent of Europe, and East Indies. No China hides were imported during the year 1905. East Indian kips and buffalo hides constituted a large percentage of the imports; there were 211,197 East Indian kips and 87,407 buffalo hides from Singapore and Batavia.

From West Africa the imports for 1905 were much larger than during the previous year—17,042 hides were imported; from Madagascar and Egypt there were imported 2,600 and 3,339 hides respectively.

The import of heavy salted hides from Italy, Germany, France, Holland, and Portugal amounted to 194,000. In addition to the above, there were also imported during 1905, 371,139 undressed goat and sheep skins; the former (goat skins) came chiefly from North Russian Ports, France, Morocco, Cape of Good Hope, Aden, and India. The latter (sheep skins) came from the Argentine Republic, Cape of Good Hope, Victoria, and New Zealand.

The accompanying table, compiled from reliable trade returns, gives the number of hides imported into Liverpool from different parts of the world during 1903, 1904, and 1905.

	River Plate.		Ox and Cow.				Brazil.	North America
			Rio Grande.		West Coast, etc.			
	Dry.	Salted.	Dry.	Salted.	Dry.	Salted.	All Sorts.	
Total, 31st Dec., 1905	22,971	176,510	—	—	23,941	19,470	69,557	3,217
" " " 1904	25,648	42,478	—	—	28,656	11,697	49,408	85,079
" " " 1903	38,801	55,753	—	—	18,404	8,932	20,484	41,128

	West India.	French, etc.	Italian.	German, etc.	Spain and Portugal.	East India.	Horse Hides. R. Plate.
Total, 31st Dec., 1905	2,096	10,425	143,024	28,138	9,539	298,606	1,000
" " " 1904	3,207	6,223	127,739	45,948	5,526	170,105	—
" " " 1903	1,118	26,338	157,550	112,244	1,154	198,768	—

The number of cases* of anthrax arising in association with the foregoing animal products which are dealt with in this paper are twenty-one in number. Thirteen of these cases were dock labourers and carters who were engaged in discharging the cargoes of ships in dock, and all, with one exception, were infected during the unloading or carting of hides either loose or in bales. Three of the twenty-one contracted infection in handling horse-hair in hair factories, whilst three were engaged in handling or sorting wools, such as sheep's wool and goat-hair. Another case was a hide porter who was infected in a hide merchant's establishment during the handling of hides and skins. An instructive case is that of a labourer who had been engaged in brushing up the holds of a vessel from which bales of skins had been discharged; he was the only one who contracted the pulmonary form of the disease. Another interesting case was that of a female bag-mender who worked amongst second-hand bags; the particular bags she was engaged upon were stated to have contained rice meal and cotton seed. There is a strong probability, however, that other bags which had contained wool or hair may have been given to her to mend. This case is comparable with two reported at Hamburg, where infection arose in mending tarpaulins which had covered sheep's wool.

From an examination of the figures in the reports of Dr. Legge, of the Home Office, it will be seen that anthrax-infected hides come from almost all parts of the world, but the principal sources of supply are China and the East Indies. Four of the twelve hide cases occurring in Liverpool were infected in handling West African hides from

* See pages 448 and 449.

Bathurst and Sierra Leone. The number of hides imported into Liverpool from West Africa is a comparatively small one, viz., 17,000 for 1905, and it must therefore be considered that the number of cases of infection from these hides is rather a high one.

Since the occurrence of these cases Messrs. Elder, Dempster & Co. have done all that is possible to safeguard the workmen handling these hides, by providing and enforcing the wearing of gloves and protective coverings for the head and shoulders, subsequently disinfecting them with perchloride of mercury. Representations have also been made to the Governor of the Gambia as to the need for proper veterinary supervision of cattle in the colony.

Hides from South America gave rise to four cases, two arose from handling skins from Mediterranean ports, and dry hides from Rangoon were responsible for another case. The sources of the material in the other cases of hide infection were not discovered.

The anthrax cases arising from handling wools were due to infected sheep's wool from the East Indies and goats' hair from Karachi.

Horse-hair gave rise to infection in three cases amongst those employed in a horse-hair factory, and the material was derived from Russian sources.

The uncovered parts of the skin were, in nearly all cases, affected in the external form of the disease, the neck in eleven cases, the cheek in four, the chin in one, the forehead in one, the nose in one, and the shoulder in one. In the latter case the man was struck on the shoulder by a box, and his skin injured by a projecting nail: he had been handling dry Rangoon hides about the same time, and carried the infection to the wound with his dusty fingers. In the case of dock labourers the pustule was mostly on the neck, due probably to carrying hides on the shoulders. In regard to the mortality amongst the twenty-one cases, they were all severe types of the disease, and there were fourteen deaths.

It seems possible that many slight forms of the disease may be overlooked by the patients or undiagnosed by the medical attendant. This neglect on the part of the workmen will not occur to such an extent amongst wool and hair sorters and amongst those who are constantly employed in one special branch of work and have come to know something of the disease and its dangers. Amongst dock labourers, on the other hand, who are constantly changing the character of their work, this elementary knowledge of the disease is wanting.

The oversight on the part of the medical man can be accounted for by the comparative rarity of the disease; and in many instances

the fact that many practitioners are not aware that the law requires the disease to be notified to the Home Office, contributes to cases being overlooked. It seems, therefore, probable that only the severe cases come to the notice of the Home Office and Health Authorities : cases where the patient has been admitted into hospital for operation, the disease diagnosed and notified to the Home Office, or in cases where the death has been registered.

Samples of hair and hides, amongst which the patients worked, have frequently been taken for bacteriological examination, but in few cases have any positive results been obtained. In many cases, owing to delay in notification and other causes, it happens that by the time the case has come under notice of the Health Authorities, the hides have either reached the tanning pits, or have been re-shipped to America and other countries, hair in bales has already been divided up and scattered, so that it would be quite impossible to trace infected material.

In the case where infection occurred in handling Karachi goat-hair, when enquiries were made it was found that the suspected bales had already been exported to Smyrna in Asia Minor. The same occurred in the case of the Rangoon hides, and the stevedore who assisted in loading the hides outward to America developed the malignant pustule and died within three days from the sailing of the ship. In some cases, however, the bales of hides or skins have been traced and reported to the manufacturers concerned. To overcome this delay in dealing with infected material, it has been recommended by the Liverpool Council that anthrax be placed amongst the diseases notifiable under the Infectious Diseases Notification Act, 1889.

This danger from anthrax is to be found wherever foreign animal products are handled, and it is interesting to note that at Hamburg, a city where the greatest attention is given to the danger of anthrax from hides and hair, the total number of cases registered during the ten years ending July, 1905, was sixty-three. In forty-three of these the infection was due to handling foreign salted and dried hides and skins ; three had handled skins of local origin, and three had been working with horse-hair and bristles, another case was infected when repairing tarpaulins which had been used as coverings for a load of sheep's wool from South Africa. In the remainder it was impossible to assign the precise source of infection. At Hamburg, the figures for the year ending December 31st, 1905, give a total of thirteen cases, with seven deaths ; seven of these thirteen cases were due to hides which came for the most part from South America, and one had been repairing wagon covers which had been used to protect animal products in railway wagons.

No.	Approximate Date of Sickness.	Sex.	Occupation.	Material.	Origin of Material.	Character of Disease and Situation of Pus-tule.	Severity and Result.	Information elicited at Inquests or Elsewhere.
1	1903. Nov. 9 ...	M	Dock labourer ...	Bales of skins ...	West Coast of Africa ...	Pulmonary anthrax ...	Death ..	The deceased assisted in brushing up the holds of the vessel in which the skins had been stored.
2	1904. April 12 ...	F	Hair sorter and washer ...	Horse-hair ...	Source unknown	Chin ...	Death	
3	May 21 ...	M	Dock labourer ...	Wool ...	Source unknown	Neck ...	Death ...	The deceased worked amongst wool six days previously.
4	June 3 ...	M	Hair washer ...	Horse-hair ...	Russia ...	Under the ear ...	Death ...	Leather gloves were supplied by the Shipping Co., and worn by the deceased.
5	July 3 ...	M	Dock labourer ...	Hides, dry ...	Sierra Leone and Bathurst ...	Neck ...	Death ...	Deceased's duty at warehouse was sweeping up loose wool, and removing same to sorting room.
6	July 19 ...	M	Wool warehouse-man ...	Wool ...	Source unknown	Chin ...	Death ...	
7	1905. April 30 ...	F	Wool sorter ...	Wool ...	East Indian ...	Forehead ...	Recovery	
8	July 3 ...	M	Dock labourer ...	Hides, dry ...	Pernambuco, Massio, and Cabadello ...	Neck, with rapid generalization ...	Death	
9	Oct. 7 ...	M	Dock labourer ...	Hides, dry ...	Bathurst ...	Neck ...	Death	
10	Oct. 30 ...	M	Dock labourer ...	Hides, dry ...	Source unknown	Left cheek ...	Severe case, recovery	
11	Nov. 29 ...	M	Dock labourer ...	Hides, dry ...	Peru ...	Neck ...	Death ...	No gloves worn or other precautions taken.

12	1906.	Jan. 28	...	M	Dock labourer ...	Hides, dry	Brazil	...	Neck	...	Recovery	It was stated that it was not usual to wear gloves.
13		Feb. 22	...	M	Dock labourer ...	Hides and skins ...	Lisbon, Oporto, and Mediterranean Ports	...	Neck	...	Death ...	
14		July 4	...	M	Dock labourer ...	Hides, dry	Parahyba	...	Cheek	...	Recovery	This patient when he took ill was working on a grain ship in B'head, but a few days previously had worked among dry hides. Gloves are worn in handling hides.
15		July 25	...	M	Hide porter	Hides and skins ...	Sources unknown	...	Cheek	...	Recovery	Gloves are worn in handling hides.
16		Aug. 18	...	M	Dock labourer ...	Hides, dry	Bathurst	...	Nose	...	Recovery	Patient was stated to have worn gloves.
17		Oct. 5	...	M	Wool warehouseman ...	Goats' hair	Karachi	...	Cheek	...	Recovery	No gloves worn, but respirators and overalls supplied to those who sweep up warehouse.
18		Oct. 23	...	M	Hair heckler	Horse-hair	Russia	...	Neck	...	Death ...	No gloves worn.
19		Dec. 5	...	M	Carter at the Docks	Goat skins, dry	Marseilles	...	Neck, extensive cedema	...	Death ...	No gloves worn.
20		Dec. 8	...	M	Stevadore	Hides, dry	Rangoon	...	Shoulder	...	Death ...	Gloves provided but not worn.
21		Dec. 16 or 17	...	F	Bag-mender in bag and sack warehouse ...	Bags	Source unknown	...	Neck	...	Death ...	The firm dealt in secondhand bags, which before the firm received them contained rice meal, cotton seed, palm kernels, and grain. There was a suspicion that the particular bags on which deceased worked had contained hair.

The measures adopted at the present time to prevent infection from this disease may shortly be reviewed.

Under the Factory and Workshops Act, 1901, Section 73, it is required that every medical practitioner attending on or called in to visit a patient whom he believes to be suffering from anthrax contracted in a factory or workshop, shall notify the case forthwith to the Chief Inspector of Factories at the Home Office. This notification starts the usual routine enquiries and preventive measures taken by the Medical Officer of Health and the local Inspector of Factories.

The Secretary of State may, under this Act of 1901, in pursuance of the powers conferred on him by Section 79, make regulations regarding the handling of dangerous material, which shall apply to all factories and workshops where dangerous trades are carried on.

The regulations under this Act in force at the present time for the express purpose of reducing the amount of dust and the likelihood of infection during the sorting and handling of wool, goats' hair and camel-hair, are very complete. The different classes of wool and hair which are known to be dangerous are scheduled, and special precautions are laid down for the opening, sorting, etc., of bales of these wools. These dangerous wools include Van mohair, Persian locks (an inferior quality), and Persian (including Karadi and Bagdad), if not subjected to the processes of willowing and sorting. Dusty and dangerous wools are required to be thoroughly steeped in water in the bale before being opened. These wools shall not be opened for sorting or manipulation except by men skilled in judging of the condition of the material.

The other wools and hair which are required to be opened either after steeping or over an efficient opening screen,* are alpaca, pelitan, East Indian, Cashmere, Russian camel-hair, Pekin camel-hair, and Persian (including Karadi and Bagdad), if subjected to sorting and willowing. All damaged wools, hair, or fallen fleeces, if of the kinds named, shall, when opened, be damped with a disinfectant and washed without being willowed.

In sorting dangerous wools and hair, this process must be done in the case of alpaca, pelitan, etc., and all mohair except Van mohair,

* 1. Area of screen in existing screens to be not less than 11 square feet; area of screen in those hereafter erected to be not less than 12 square feet; nor shall length or breadth be less than $3\frac{1}{2}$ feet.

2. At no point of the screen within 18 ins. from the centre shall the velocity of the exhaust draught be less than 100 linear feet per minute.

over an efficient sorting board* with mechanical exhaust draught and in a special room for the purpose. Van mohair and Persian locks shall be sorted only in the damp state and after being washed.

No damaged wools or hair of the kinds scheduled as dangerous shall be sorted except after being washed, and in the willoving of dangerous wools this shall only be done in a proper machine with mechanical exhaust draught to draw dust away from the workman, and in a special room for the purpose.

Further, rules are laid down regarding the storage of wool and hair, the air space (1,000 cubic feet per person), the air inlets, and the temperature, which shall not fall below 50° F. All bags which have been used for packing wool or hair shall be picked clean and not brushed, all clippings, etc., shall be removed for disinfection or destruction. Dust from opening screens, sorting boards, etc., shall be discharged into proper receptacles and not in the open air. Overalls and respirators shall also be provided for those engaged in the work of collecting and removing the dust, the floors of various rooms shall be sprinkled daily with disinfectant after work and swept immediately, and lime-washing shall be done once a year. In connection with the rooms for handling dangerous wools there shall also be provided suitable places for washing and for the storage of food and clothes, and persons having open cuts or sores shall be prohibited from working in the rooms when dangerous wools are manipulated. According to Dr. Legge a marked reduction in the risk of anthrax is seen as a result of scheduling dangerous wools. When Mr. Spear made his enquiries in 1882 Van mohair was the wool which was placed first on the list of noxious wools as regards anthrax. At the present time, from Dr. Legge's figures, this wool appears third on the list, and he points out that this is in all probability due to it being classed as a dangerous wool and scheduled to be sorted while damp.

It is interesting to note, in connection with preventive measures, that an Anthrax Investigation Board was established over a year ago at Bradford, to enquire into the origin and spread of anthrax, and, in the interests of all concerned, to devise means for diminishing the risks attached to the manipulation of dangerous wools.

* The sorting board shall comprise a screen of open wire work, and beneath it at all parts a clear space of not less than 3 inches in depth. Below the centre of the screen there shall be a funnel, measuring not less than 10 inches across the top, leading to the extracting shaft, and the arrangements shall be such that all dust falling through the screen and not carried away by the exhaust can be swept directly into the funnel. The draught shall be maintained in constant efficiency whilst sorters are at work, and shall be such that not less than 75 cubic feet of air per minute are drawn by the fan from beneath such sorting board.

It appears likely that the Secretary of State will shortly schedule amongst dangerous wools those of East Indian origin, the danger attending the manipulation of these wools being not inconsiderable. Out of 126 reported cases of anthrax in the woollen, worsted, and felt industries, between January 1st, 1900, and November 20th, 1906, there were 17 in which East Indian wool was the most likely cause. There is some reason to believe that wools of Persian origin find their way to such ports as Bombay and are shipped amongst those classed as East Indian. Much opposition has been raised to the proposed regulations by those in the wool industry, who point out that no real case has been made out as to the noxiousness of East Indian wools, and that it is only in very small quantities that Persian wools find their way amongst East Indian. Much might be done to diminish the risk of infection if some precautions were taken by those who make up the bales to see that fallen fleeces and damaged or inferior wools were not incorporated in the bales of good wool, but packed separately.

Although no special regulations exist for the handling of horse-hair and bristles in hair factories, the question of preventive measures has not escaped the notice of the Chief Inspector of Factories. Efforts have already been made to control the risk of anthrax arising in connection with horse-hair by the manufacturers themselves. In 1899 they resolved to buy none of the dangerous Russian, Siberian, or Chinese hair unless sufficient guarantees were given by the seller that the hair had been properly disinfected. In a circular letter issued in 1900 by the Chief Inspector of Factories it was pointed out that there were doubts as to whether this disinfection could be carried out in practice and that such a guarantee would be of little value. Pending enquiry into the question of steam disinfection, he recommended other means of dealing with the untreated horse-hair so as to reduce the risk. These were the opening and sorting of the hair over tables with a mechanical down draught, the covering of the carding and dust-extracting machines, the collection, removal, and destruction of the dust by heat, the exclusion of work-people with cuts and wounds, and the provision of proper washing accommodation.

It is understood that special rules are now in course of preparation in connection with this industry. Pending the issue of these rules, it has been recommended that dangerous Siberian, Chinese, and Russian hair should be thoroughly steeped in water or in a disinfectant before opening and sorting. From experiments made in Liverpool this steeping does away with a great amount of the dust which formerly arose in this process. Some difficulty, however, is being experienced

with the workers, who are very unwilling to do the work at the former prices, and it is stated by the sorters and drawers that certain disinfectants recommended render the hair sticky. These difficulties are, however, met with amongst workmen engaged in nearly all dangerous trades, and they are slow to recognize the advantage of any particular safeguard. One cannot but think that good results will follow the steeping in water of all horse-hair bales and the sorting of the hair in a damp state.

Disinfection by steam has also been recommended, but is only done in some factories. Hair workers state that it deteriorates the quality of the hair, makes it brittle at the ends, and the material loses its elasticity. These statements coincide with the results obtained by Messrs. Webb and Duncan, of Worcester, in their exhaustive experiments. They have pointed out, however, that the results to a large extent depend on the pressure to which the hair is subjected during disinfection. They also found that bristles change colour and lose weight through brittleness and that white hair is also discoloured. The danger of anthrax is much lessened when, as in the case of China white hair, the material has been already washed, or in the case of bristles where the pigs have been scalded before the bristles are collected.

The Medical Board of Hamburg, as early as 1874, drew attention to the illness and carbuncles which arose amongst those cleaning, combing, and sorting Siberian horse-hair, owing to infection of anthrax adhering to the hairs, and advised :—

1. No food to be partaken of where such hair is stored or worked.
2. Thorough cleansing of the hands, etc., after finishing work.
3. Persons with open sores or abrasions to abstain from work.
4. Immediate medical advice to be obtained when first symptoms appear.

Legislation was first introduced in Germany in 1899, and was subsequently amended by an Act of 1902. This concerned the arrangements and methods of work in horse-hair spinning mills, hair and bristle dressing and brush factories. The regulations under this Act apply to all premises where horse- or cow-hair, pigs' bristles or pigs' wool, or goat-hair are treated or worked, or where they are made into brushes, brooms, etc. Firstly, it is required that the material shall be disinfected before being used in manufacture, and choice of three methods is given :—

1. Material is subjected for half an hour to current of steam at a pressure equivalent to 17 lbs. (220° F).
2. The hair is boiled for a quarter of an hour in a 2 per cent solution

of permanganate of potash, and subsequently bleached in 3-4 per cent sulphurous acid.

3. The hair is boiled in water for at least two hours.

Where the material can be shown to have been already properly disinfected before coming into the manufacturer's hands, or, in the case of white bristles which are subjected to further bleaching processes or have been already bleached before coming into his hands, no disinfection is required. Prior to this disinfection only such processes shall be carried out as are necessary for judging of the quality and condition of the material, or the unpacking and conveying of it to the apparatus.

No workmen with external cuts or sores, especially on the neck, face, or hands, shall be employed on this work.

A register shall be kept of the amount, source, and country of origin of hair, bristles, and wool, and the duration and mode of disinfection employed, and if no disinfection is carried out, the reason for this. Bales of material requiring disinfection shall be kept in special lock-up rooms.

In Germany, for large factories where over ten persons are employed, special regulations have been made. First, as regards the character of the floors, walls, and ceilings, so that dust may be easily removed by the wet method. The surface of the walls and ceiling, unless having a smooth washable surface such as paint, shall be limewashed once a year. In addition, when the development of considerable quantities of dust is incidental to the operations, 530 cubic feet of air space shall be allowed to each workman.

In horse-hair factories and hair and bristle dressing workshops, sorting and heckling shall be done in a special room, and the dust created shall be collected and destroyed. Mixing, willowing, and heckling machines shall be covered over and provided with efficient dust-extracting apparatus, and if the dust be from materials such as cannot be subjected to disinfection without serious damage, it shall be burnt.

Sufficient and suitable overalls and head coverings shall be provided for the persons employed in the preliminary manipulation of non-disinfected material. These overalls shall be kept in a special place, and disinfected regularly once a week. Facilities shall be provided for the persons engaged to have a warm bath twice weekly. Lavatories and cloak-rooms shall also be provided. A written agreement shall also be entered into with the work-people regarding the wearing of overalls, the partaking of food outside the work-rooms, and the washing of the face, neck, and hands before meals. Employers may also

dismiss without previous notice any worker who persists in disregarding the rules.

Elaborate experiments have been made by the German Imperial Health Office, and also by Mr. Webb of Worcester, on the disinfection of hair, especially in regard to its effects on the material. It has been found that hair suffers no damage in disinfection by saturated steam, if the pressure does not exceed $2\frac{1}{2}$ lb. above atmospheric pressure (i.e. 220° F.). The German rules have been in force since 1899, and no difficulty has been experienced. The only unavoidable damage which occurs is that white hair is turned yellow even at low pressures, bristles become brittle, and those that are white are coloured slightly yellow.

Before special rules are issued for hair and bristle factories in this country, the whole question of soaking the hair or disinfecting it by steam will, no doubt, be well considered by the Home Office authorities in conjunction with the representatives of the various hair industries.

There remains now to be considered the nature of the precautions to be taken in connection with the handling of hides and skins. The risks arising from infected hides and skins are almost as great as those connected with the wool trade. From Dr. Legge's figures for the years 1899-1904, the number of cases is 88 for the wool industry and 86 for the hide and skin trade.

The special rules suggested in 1898, under the Factory and Workshops Act, included the sorting of all foreign hides and skins and dry East Indian hides and skins. Much opposition was, however, raised by the trade, and it was decided by the Secretary of State, in view of this and of the records available at that time as to the countries of greatest risk, to limit the rules to hides and skins from China and the West Coast of India. In addition, the compulsory wearing of gloves and overalls was omitted, these protective garments being simply recommended to those concerned, and the wearing was not made compulsory.

The amended rules came into force in 1901, and the occupier is required to make arrangements in connection with the storage of food, washing and dressing accommodation, and publishing the rules. The workmen are also directed regarding the storage and partaking of foods, and their attention drawn to the danger of working amongst hides and skins with wounds or scratches on the body. A foot-note is appended recommending the wearing of suitable overalls for protecting the neck and arms; the wearing of gloves is also advised where the character of the work permits.

Protective gauntlets and gloves have been provided in Liverpool

by many shipping firms and others for their workmen, but the difficulty of getting the men to wear them is great, and the responsibility of seeing that they are worn when there is no personal supervision is one that employers do not care to undertake. Many of the gloves worn are unsuitable in shape for such a purpose; the gauntlet form is no doubt the best, but the form of glove needs much improvement.

There can be no doubt that gloves are a protection, but they may also harbour infection by dust finding its way into the interior. Some companies disinfect the gloves after use with perchloride of mercury.

Notices have also been drawn up by the Chief Inspector of Factories and posted up in places where China and East Indian hides and skins are handled, drawing attention to the disease, how it is communicated, to the need for prompt recognition of the early signs of the disease, and immediate attendance at a hospital.

This notice was supplied in 1902 to the Liverpool Shipowners Association, who had it printed and posted up over the docks. During the year 1906 a further excellent notice has been issued by the Home Office, with three coloured representations of the malignant pustule in various stages.

In the beginning of 1906 the cases of anthrax became so frequent that the Port Medical Officer, Dr. Hope, issued a circular letter drawing the attention of shipowners and others to the rules and recommendations which had been prepared by the Chief Inspector of Factories to avert the danger, and especially with regard to the wearing of suitable gloves and overalls, and this was no doubt productive of some good.

The recommendations for handling hides at large foreign seaports are of interest. In German ports, and especially at Hamburg, where so many cases have occurred, the measures taken, as in our own country during past years, have been chiefly directed towards calling the attention of workmen and others to the risks connected with the occupation, and to induce them to cleanse places where hides and skins are stored, also to the need for personal cleanliness after work, and to protect the hands, arms, and neck with gloves and overalls, and to prevent workmen with sores and cuts from handling such materials.

In 1891 the Imperial Chancellor issued a notice with regard to injury to health arising in the trade of foreign hides, and it was recommended as follows :—

1. Store places for hides should be at some distance from habitations, and animals should be prevented from having access to these places.

2. Sheds and buildings serving for storage of fodder and straw are not suited for storage of raw hides.

3. Stirring up dust in sorting, packing, and handling hides should be avoided.

4. Places where foreign hides have been stored should afterwards be cleansed and disinfected at proper intervals.

5. Bark used in tanning processes, hair and waste straw, etc., used in packing animal products, should be burnt or disinfected.

6. Persons with cuts, wounds, etc., should not be admitted to work with hides.

7. Personal cleanliness, especially of face, hands, arms, hair, and beard should be attended to before leaving the locality of work.

8. Cleansing of store places, etc., should be done in the wet form.

9. The disinfectants recommended are :—

Chloride of lime—1 part fresh chloride of lime and 3 parts water.

Carbolic sulphuric acid—2 parts crude carbolic acid, and 1 part crude sulphuric acid, and 4 parts water.

A notice was issued in April, 1902, by the Medical Board of Hamburg, and posted up in conspicuous situations in work-places. A further caution was issued in June of the same year, with a description of the first signs of the disease. This was communicated by the Union of Dock Labourers and other workmen to its members.

At Marseilles and Antwerp the British Consul reports that cases are very rare and no precautions are adopted to prevent infection. At Genoa it is reported that no special sanitary regulations for the handling of hides have been issued, but the following recommendations were issued to those engaged in the work :—

1. To abstain from handling hides when they have cuts or abrasions of the skin.

2. To disinfect the hands and uncovered parts of the arms, by washing them in 1 in 1,000 corrosive sublimate every time they have handled hides.

3. To protect the shoulders and neck with a wadded covering when they carry hides on the shoulders.

From further enquiries which have been made it is essential, according to Federal law, that all hides imported into the United States of America must be disinfected before shipment in the country whence they are exported, except such countries as are free from contagious or infectious diseases of animals. Unless the imported hides are accompanied by a consular certificate stating that they have come from an anthrax-free country or have been disinfected, they are not allowed to be landed.

A circular of the United States Treasury Department, dated 1901, directs all Customs officers, with a view to prevent the introduction

and spread of contagious or infectious diseases amongst the cattle of the United States of America, to treat as prohibited importations all hides of cattle, calf-skins, hide-cuttings, etc., except such as have been drysalted, arsenic-cured, or lime-dried after soaking for forty days in strong solution of lime, and except abattoir hides, the product of Sweden, and Norway, and Great Britain, in all cases where the invoices are not accompanied by proper certificates of disinfection.

The Board of Health of New York, under Section 152 of its Sanitary Code, has power to prevent the unloading of foreign hides at any pier or wharf, without, or otherwise than according to, a permit from the Board.

It would seem then, that, in the United States the authorities regard the drysalting and arsenic- or lime-curing of hides sufficient to render them innocuous, and the British Consul General at Boston has made enquiries and finds that this is the case with hides from India, but that great care is exercised in handling hides from China. From the answers obtained from the authorities it does not seem that there are any special local sanitary regulations for the handling of hides.

Dry hides, whether sun-dried or treated with arsenic or lime, are more often responsible for causing infection than the wet kind; and it was suggested some years ago by Dr. Hamer, that the substitution of wet for dry hides would be followed by a decrease in anthrax cases. Unfortunately, according to trade returns, no marked effort seems to have been put forth, so far, by importers, to effect this evident means of prevention. Dry hides are much lighter than wet ones, and this is a factor which appeals very forcibly to importers.

The suggestion is made that if hides and skins were imported in large bales properly covered over and tied up, so that mechanical means of removal from holds and elsewhere would be required, it would materially aid in diminishing the risk of infection, at least at the docks, from the reduction of manual labour. In hide markets and tanneries, where the bales would be opened and the hides sorted, the risk would still exist.

So far, then, our methods of prevention, short of the disinfection of the hides, which cannot, in the opinion of many, be carried out in a practical and effectual manner, may be summarized as follows:—

1. Notices and circular letters to educate workmen and their employers as to the nature and fatality of the disease and early attention to medical treatment.

2. All foreign hides from infected or suspected countries ought to be scheduled under the special rules; gloves to be worn and disinfected after use.

3. Dry hides and skins ought to be imported only in large and in canvas-covered bales, requiring mechanical means for removal.

4. The substitution of "wet" for "dry" hides.

5. No hides to be carried on the shoulders.

6. All sheds and store places, after the storage of hides or skins, ought to be thoroughly wet-cleansed and disinfected.

7. Infected material ought to be traced to its source of origin and representations made through the proper channels to the Governments concerned, recommending a close veterinary inspection of cattle, with a view to eradicate the disease.

Recommendations 6 and 7 ought also to apply to infected wool and hair.

The inclusion of anthrax amongst the diseases notifiable under the Infectious Diseases Notification Act, 1889, would be a step in the right direction, and would enable Health Authorities to follow up and deal promptly with infected material. It has been recommended that the disease be placed amongst the compulsorily notifiable diseases under this Act in Liverpool.

This record of a series of cases of anthrax and the short review of our present methods of preventing infection may assist in arousing interest and suggest improvements in our administrative methods.

RETURNS OF OUTWORKERS UNDER THE FACTORY ACT.—On February 22nd, at the Guildhall, several tailors and clothiers were summoned, at the instance of one of the City of London sanitary inspectors, for neglecting to send to the Court of Common Council (the local authority) a list of the names and addresses of all persons employed by them outside the workshops. Mr. T. G. Vickery, who prosecuted on behalf of the Public Health Department, pointed out that under the Factory and Workshop Act, 1901, the occupier of every workshop or factory was required, on or before February 1st and August 1st in each year, to supply the local authority with the names and addresses of persons employed by them as outworkers. Certain trades were specified, and the object was that the sanitary authorities should have complete control over the homes of people engaged in making articles of clothing for the purposes of trade in their own houses. Last October the Home Office issued a circular to all local authorities, impressing on them the necessity of seeing that the provisions of this section were carried out, and the object of these prosecutions was to make it widely known to those concerned what they were required to do, and to act as a warning to other defaulters. It was as much for the protection of the general public as for the individual outworker that the Act should be rigidly carried out. The Alderman, observing that these cases were intended to act as a caution, imposed only nominal fines. Future offenders would be dealt with in a different manner.