

of the ulceration is assisted by the specific causal agent as well as by the penetration of facultative parasitic bacteria.

It appears probable that the virus is of a fixed character, and contained principally in the fæces and vomit of diseased animals, possibly also in the urine, the blood, and the other tissue juices. It is questionable whether it is present in a fluid condition in the expired air, etc. Although up to the present time the actual mode of transmission of the virus has not been definitely determined, it cannot be doubted that direct infection from animal to animal, in consequence of licking, etc., takes place, and it is also certain that the disease may be transmitted by intermediary bearers of the most varied kind, such as water, food, persons, and objects of all kinds. The spontaneous development of the causal agent is, of course, out of the question.

From what locality the disease was introduced into Stuttgart is difficult to determine. Apparently the same disease was recently observed in other towns (Frankfurt, Hamburg, and Wiesbaden). To my knowledge, however, the disease first prevailed in Stuttgart, from which it appears to have been carried to these other towns. It has been suggested that the disease was spread by dogs which, shortly before the disease broke out in epizootic form, had been exhibited in a dog show in Stuttgart. As a matter of fact, it is said that some of the animals there were seized with striking symptoms. Our inquiries, however, with regard to that matter did not elicit such corroboration as is desirable in the investigation of such points, and hence this question still remains in obscurity.

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### RESULTS OF THE APPLICATION OF THE TUBERCULIN TEST TO HER MAJESTY'S DAIRY COWS AT WINDSOR.

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AT a meeting held at Marlborough House on Tuesday, the 20th December last, to further the objects of the National Association for the Prevention of Consumption and other forms of Tuberculosis, His Royal Highness the Prince of Wales mentioned that Her Majesty the Queen had given authority to destroy thirty-six out of forty of her dairy cows at her Home Farm, because on being tested by tuberculin they had been found to be tuberculous. This statement obtained wide publicity, and it has naturally excited a great deal of interest among owners of cattle and others who are specially concerned in the eradication of tuberculosis from dairy stock. On several occasions a desire has been expressed for fuller information regarding the matter, and official sanction has been given to the publication of the following detailed account of the circumstances in question.

The animals tested formed the herd of unpedigreed cows kept for the supply of milk at Her Majesty's Home Farm at Windsor. These animals were under the veterinary care of Messrs Allnutt & Tennant, Veterinary Surgeons, Windsor, and the whole of them were in good condition and apparently healthy. Notwithstanding this, it occurred

to those responsible for the management of the herd that, in view of the accumulated evidence of the accuracy of the indications afforded by tuberculin, and the desirability of excluding from the herd every animal affected with tuberculosis, however slightly, the whole of the cows ought to be tested. Professor Sir George Brown, C.B., when consulted supported this view, and the test was accordingly carried out on the 15th and 16th of September 1897.

The temperatures of all the animals had been taken by Mr Tennant on the 14th September, and with one exception they were then normal, or at least under  $103^{\circ}$  F. The exception was the cow "Snowball," No. 32 in the following list, and her temperature was  $104^{\circ}$ .

The tuberculin was injected on the 15th September, commencing at 11 A.M. The temperature of each animal was taken just before it was operated upon, and again at the third, sixth, ninth, twelfth, and fifteenth hour afterwards.

When the temperature charts were examined on the 16th September it was found that, accepting a gradual rise of temperature from the normal to  $104^{\circ}$  or more as evidence of the existence of tuberculous disease, at least thirty-two of the cows appeared to be affected, while only five could be pronounced healthy, and the remainder doubtful.

To retain the animals that had reacted in the herd was undesirable, and it was therefore decided that the whole of these should be killed and submitted to a searching *post-mortem* examination.

Subsequently it was thought that the observations made on the reacting animals would have a greatly enhanced value if the non-reacting animals and those in which the reaction appeared doubtful were also submitted to a careful search for evidence of disease after death, and, accordingly, the whole of the cows were killed and examined at the Royal Veterinary College within a few weeks after they had been tested. The results are set forth below.

No. 1.—Jersey, "Marionette."

*Temperature.*— $103^{\circ}$ ,  $101^{\circ}$ ,  $101.3^{\circ}$ ,  $104^{\circ}$ ,  $106^{\circ}$ ,  $105.2^{\circ}$ .<sup>1</sup>

*Autopsy.*—Bronchial and mediastinal glands much enlarged, the latter as large as the fist, and caseating. The right lung contains three areas of caseating broncho-pneumonia. Hepatic lymphatic glands contain caseous tubercles. One mesenteric gland contains caseating tubercles.

No. 2.—Jersey, "Surprise."

*Temperature.*— $103.1^{\circ}$ ,  $101.4^{\circ}$ ,  $102^{\circ}$ ,  $105.4^{\circ}$ ,  $106.3^{\circ}$ ,  $105.8^{\circ}$ .

*Autopsy.*—Bronchial and mediastinal glands much enlarged, and full of caseating tubercles.

No. 3.—Jersey, "Bosis."

*Temperature.*— $101^{\circ}$ ,  $100.8^{\circ}$ ,  $101.4^{\circ}$ ,  $104^{\circ}$ ,  $104.7^{\circ}$ ,  $104.9^{\circ}$ .

*Autopsy.*—Bronchial and mediastinal glands much enlarged, caseous, and calcified. The mediastinal gland is as thick as one's wrist, and about 6 inches long. Several areas of broncho-pneumonia in the right lung. A fringe of "grapes" along the edge of the left lung, and similar growths on the diaphragm. Hepatic lymphatic glands contain yellow tubercles. Nearly the whole of the mesenteric glands contain distinct tubercles.

<sup>1</sup> The temperatures given for each animal are those recorded at the time of injection, and at the third, sixth, ninth, twelfth, and fifteenth hours afterwards.

No. 4.—Jersey, "Polly's Pet."

*Temperature*.—101°8', 102°4', 103°4', 106°6', 105°8', 105°2'.

*Autopsy*.—Left and right bronchial glands and mediastinal glands contain yellow tubercles. The right fore quarter of the udder contains a foetid abscess as large as the fist.

No. 5.—Shorthorn, "Alex."

*Temperature*.—102°2', 102°, 103°3', 106°, 107°5', 105°6'.

*Autopsy*.—Right bronchial gland contains yellow caseous tubercles; mediastinal ditto and partly calcified. Small echinococcus cyst in right lung. A portion of the right posterior quarter of the udder is in a condition of acute non-tuberculous inflammation.

No. 6.—Shorthorn, "Jenny."

*Temperature*.—102°6', 101°6', 102°6', 104°, 105°8', 106°7'.

*Autopsy*.—Bronchial and mediastinal glands enlarged and caseating. One small pea-sized area in the right lung commencing to caseate.

No. 7.—Shorthorn, "Cherry."

*Temperature*.—101°2', 100°8', 102°, 103°, 103°8', 103°8'.

*Autopsy*.—Bronchial and mediastinal glands contain a few yellow tubercles. Numerous echinococcus cysts in the lungs. Left kidney contains an echinococcus cyst about the size of a pigeon's egg. Liver contains numerous echinococcus cysts.

No. 8.—Shorthorn, "Honesty."

*Temperature*.—101°4', 102°2', 103°, 105°4', 105°1', 103°.

*Autopsy*.—Bronchial and mediastinal glands enormously enlarged and caseous. Over the heart a gland is as large as a cocoa-nut, and the mediastinal gland is as large as an ox kidney. Numerous areas of tuberculous broncho-pneumonia in each lung. A pharyngeal gland on each side is as large as a turkey egg, and softened centrally. Hepatic lymphatic glands enormously enlarged—four times as large as the fist—caseating, and softened. About the half of the mesenteric glands contain caseating tubercles.

No. 9.—Jersey, "Cloud."

*Temperature*.—101°, 101°6', 102°5', 104°9', 105°8', 105°5'.

*Autopsy*.—Mediastinal gland contains yellow tubercles. Pharyngeal glands on both sides contain tubercles.

No. 10.—Jersey, "Mayflower."

*Temperature*.—101°5', 102°6', 103°1', 103°4', 106°, 104°2'.

*Autopsy*.—Right bronchial gland enlarged and caseating. One small (pea-sized) distinctly caseating lesion in the right lung. Pharyngeal glands on both sides enlarged to size of pullet's egg, and one on each side caseating.

No. 11.—Jersey, "Tulip."

*Temperature*.—101°, 101°, 102°2', 104°4', 106°7', 104°9'.

*Autopsy*.—Bronchial glands on both sides contain caseous tubercles. Mediastinal glands much enlarged and caseating. All the pharyngeal glands somewhat enlarged; one on each side caseous. Three of the mesenteric glands enlarged, caseating, and calcified.

No. 12.—Shorthorn, "Fawsley."

*Temperature*.—102°2', 101°9', 103°7', 105°4', 106°, 105°2'.

*Autopsy*.—Right bronchial gland enlarged and caseating; a single yellow tubercle in the left bronchial gland.

No. 13.—Shorthorn, "Beauty."

*Temperature*.—103°, 103°8', 103°1', 104°, 106°2', 106°2'.

*Autopsy.*—Right bronchial gland enlarged and caseating; also one or two yellow caseous nodules in mediastinal glands.

No. 14.—Jersey, "Bustle."

*Temperature.*—102°6', 106°5', 107°, 106°7', 107°6', 106°2'.

*Autopsy.*—Mediastinal glands very much enlarged—as thick as the wrist. Two areas of caseating broncho-pneumonia in the right lung; one ditto in the left lung. Pharyngeal glands somewhat enlarged, but not distinctly caseous.

No. 15.—Jersey, "Bonny."

*Temperature.*—101°6', 102°7', 102°2', 103°1', 105°8', 104°.

*Autopsy.*—Left bronchial gland enlarged and filled with caseous nodules. Several yellow nodules in the mediastinal gland.

No. 16.—Jersey, "Pearl."

*Temperature.*—102°, 102°9', 104°9', 107°6', 105°8', 105°8'.

*Autopsy.*—Left and right bronchial and mediastinal glands enlarged and caseating.

No. 17.—Shorthorn, "Betty."

*Temperature.*—101°5', 101°6', 102°4', 104°9', 106°2', 105°8'.

*Autopsy.*—Right bronchial and mediastinal glands contain caseous and calcified lesions. Area of caseating broncho-pneumonia in right lung. One mesenteric gland caseous and calcified.

No. 18.—Shorthorn, "Nell."

*Temperature.*—101°, 101°2', 101°5', 105°8', 104°9', 102°3'.

*Autopsy.*—The left fore quarter of the udder contains a spherical necrotic mass about as large as a walnut, and surrounded by a fibrous capsule. The surrounding gland tissue is perfectly normal. Lymphatic glands of the udder normal. Right lung contains three areas of tuberculous broncho-pneumonia, the largest the size of a hen's egg. The left contains two such areas, the largest about the size of a hen's egg; all are extensively caseated. Liver contains several echinococcus cysts, one partially calcified. Two of the mesenteric glands contain numerous caseating tubercles.

No. 19.—Shorthorn, "Primrose."

*Temperature.*—102°, 101°6', 102°2', 101°3', 101°3', 105°8'.

*Autopsy.*—No tuberculous lesions were found in this animal. The uterus contained about a quart of turbid, non-putrid liquid, and its mucous membrane was inflamed. A cyst as large as the fist was present on the course of the left Fallopian tube.

The following glands and organs were minutely examined:—The lungs, liver, kidneys, spleen, and udder; and the pharyngeal, pre-scapular, prepectoral, bronchial, mediastinal, suprasternal, mesenteric, hepatic, gastric, precrural, popliteal, and supramammary lymphatic glands.

No. 20.—Jersey, "Lily."

*Temperature.*—101°4', 101°4', 101°7', 104°6', 106°, 103°1'.

*Autopsy.*—Bronchial and mediastinal glands much enlarged and caseous. Several areas of caseating broncho-pneumonia in the right lung. One parasitic cyst in the left lung. Pharyngeal glands enlarged, but not caseating. The liver contains a fibrous nodule about the size of a walnut, with suppurating or caseous centres in it, and at the left extremity of the liver there are two similar lesions. A splenic lymphatic gland is indurated and caseating.

No. 21.—Jersey, "Julia."

*Temperature*.—101·8°, 101·4°, 103·2°, 105·2°, 105·7°, 105·1°.

*Autopsy*.—Mediastinal gland enlarged and caseating. Right lung contains one pea-sized caseating area of broncho-pneumonia; the left lung contains a similar area about as large as a hen's egg. The bronchial glands are enlarged, one of them to the size of a turkey egg; the latter is extensively softened, and contains a yellow custard-like material. One caseating tubercle in a mesenteric gland.

No. 22.—Jersey, "Bonbon."

*Temperature*.—101·4°, 101·4°, 101·8°, 104·6°, 106°, 105°.

*Autopsy*.—Bronchial gland on right side caseated almost throughout; mediastinal gland also contains some yellow tubercles. One caseating broncho-pneumonic area in right lung. A pharyngeal gland on the right side is enlarged to the size of a goose egg, cirrhotic, and filled with caseating tuberculous nodules.

No. 23.—Jersey, "Jessie."

*Temperature*.—101°, 100·6°, 101·1°, 104°, 106°, 105°.

*Autopsy*.—Tubercles in both bronchial glands and in mediastinal gland. Two tuberculous broncho-pneumonic areas in the right lung, each about the size of a hazel nut; the left lung contains about half-a-dozen such areas. The hepatic lymphatic glands contain caseating yellow tubercles. One partially degenerated echinococcus cyst in the liver. Two mesenteric glands contain numerous caseating tubercles.

No. 24.—Jersey, "Molly."

*Temperature*.—102°, 102·2°, 104°, 106·7°, 105·8°, 105·8°.

*Autopsy*.—Bronchial glands both caseating—the left as large as a goose egg. Mediastinal gland enlarged and caseating. The left lung contains a caseating area about as large as a hen's egg, and another about as large as a walnut.

No. 25.—Jersey, "Milkmaid."

*Temperature*.—101·8°, 102·6°, 102°, 101°, 101°, 101°.

*Autopsy*.—No tuberculous lesions found.

No. 26.—Jersey, "Mirror."

*Temperature*.—101°, 101·4°, 102·3°, 102·4°, 104°, 101·2°.

*Autopsy*.—Caseous tubercles in left bronchial and mediastinal glands. One caseous tubercle about the size of a hazel nut in left lung.

No. 27.—Kerry, "Brownie."

*Temperature*.—101·6°, 101·4°, 101·4°, 101·4°, 102·4°, 104·3°.

*Autopsy*.—Right bronchial gland enlarged to the size of a walnut; with the exception of a thin capsule it is entirely caseous and softened.

No. 28.—Shorthorn, "Brocade."

*Temperature*.—101·8°, 101·4°, 101·2°, 101°, 101·2°, 103·6°.

*Autopsy*.—Some small caseous tubercles in the left bronchial gland. Large foetid abscess at the portal fissure of the liver.

No. 29.—Shorthorn, "Sally."

*Temperature*.—101·6°, 102°, 102·5°, 101·7°, 101·2°, 98·6°.

*Autopsy*.—No tuberculous lesions were found in this animal.

No. 30.—Shorthorn, "Rosebud."

*Temperature*.—101°, 101·2°, 101·4°, 100·2°, 99·8°, 100·4°.

*Autopsy*.—The mediastinal lymphatic gland contained a pea-sized caseous nodule. Microscopic examination showed fairly numerous tubercle bacilli in the caseous material.

No. 31.—Shorthorn, "Judy."

*Temperature*.—101·6°, 100·8°, 103·4°, 100·8°, 100·8°, 100·4°.

*Autopsy*.—No tuberculous lesions discovered.

No. 32.—Shorthorn, "Snowball."

*Temperature*.—102°, 103·1°, 102·6°, 103·1°, 105·8°, 105·8°.

*Autopsy*.—Yellow caseous tubercles in both bronchial and mediastinal glands. Small focus of broncho-pneumonic tubercle in base of right lung. Liver cirrhotic from flukes. Several mesenteric glands enlarged and caseating.

No. 33.—Jersey, "Trophy."

*Temperature*.—101·8°, 101·6°, 101·8°, 101·4°, 103·2°, 104°.

*Autopsy*.—Caseous tubercles in both bronchial and mediastinal glands. Small caseating area in the right lung.

No. 34.—Shorthorn, "Strawberry."

*Temperature*.—102·2°, 101·8°, 102·8°, 104·5°, 106·7°, 106·4°.

*Autopsy*.—A few tubercles in the right bronchial gland.

No. 35.—Shorthorn, "Mary."

*Temperature*.—101·4°, 101·6°, 102·4°, 101·3°, 103·5°, 104°.

*Autopsy*.—One caseous tubercle about the size of an oat-seed in the mediastinal gland. The mammary gland on both sides is the seat of suppurative inflammation, and in the left half there is a large abscess with thick yellow pus. Mammary lymphatic glands on both sides normal.

No. 36.—Jersey, "Rosit."

*Temperature*.—101°, 101·6°, 103·1°, 105·8°, 106°, 105·8°.

*Autopsy*.—Caseating tubercles in left bronchial gland and in mediastinal gland.

No. 37.—Shorthorn, "Nelly."

*Temperature*.—102°, 103°, 103·1°, 107·6°, 106·7°, 105·8°.

*Autopsy*.—Tubercles in bronchial glands on both sides. An area of broncho-pneumonic tubercle in the left lung and also a degenerated echinococcus cyst. Yellow caseating, partly calcified, tubercles in two mesenteric glands.

No. 38.—Shorthorn, "Dolly."

*Temperature*.—101·4°, 101·8°, 105·3°, 106·2°, 105·8°, 104°.

*Autopsy*.—Bronchial and mediastinal glands much enlarged, caseating, and partly calcified. Numerous grapy growths on the right pleura. Numerous areas of caseating nodular tuberculous broncho-pneumonia in each lung. At one extremity of the spleen a good deal of inflammatory fibrous tissue has been formed, and at the centre of this, but not involving the splenic substance, there is an abscess with thick yellow pus. Both surfaces of the diaphragm are studded with grapy growths, largest and most numerous on the pleural surface. Nearly all the mesenteric glands contain caseating tubercles. The left supramammary lymphatic gland is indurated and contains several caseous and partly calcified tuberculous nodules, the largest as large as a hazel nut; no trace of tuberculosis in any part of the udder.

No. 39.—Shorthorn, "Bertha."

*Temperature*.—101·8°, 102·7°, 102·6°, 103·1°, 105·8°, 104·9°.

*Autopsy*.—The left bronchial lymphatic gland contains one tubercle, partially calcified.

No. 40.—Shorthorn, "Hope."

*Temperature*.—101°, 102·2°, 102·4°, 102·2°, 104·9°, 106·7°.

*Autopsy*.—Yellow tubercles are present in bronchial and mediastinal glands and in one mesenteric gland.

In interpreting the results of an injection with tuberculin it is customary to regard a rise of temperature from the normal (about 102°) to 104° or over during the fifteen hours following the operation as evidence of tuberculosis, and to consider those animals in which there is practically no disturbance of temperature within that time as free from tuberculosis.

Analysing the foregoing details, it will be seen that in thirty-four of the animals the temperature rose to 104° or more, and thirty-three of these were found to be tuberculous on *post-mortem* examination.

In the remaining animal (No. 19 in the list) no tuberculous lesion could be found, but the uterus was diseased. It will be observed that in this animal, although the temperature rose to 105·8°, the rise was sudden and did not occur until after the twelfth hour. Probably the disturbance of temperature in this instance was connected with the uterine disease, and the case illustrates one of the possible sources of error in the use of tuberculin.

In four of the animals (Nos. 25, 29, 30, and 31) the temperature remained practically undisturbed<sup>1</sup> during the fifteen hours after the operation, and, with the exception of No. 30, these cows appeared to be free from tuberculous disease on *post-mortem* examination.

Lastly, two of the animals (Nos. 7 and 28) had to be classed doubtful, the temperature rising in the one case to 103·8°, and in the other to 103·6°. Tuberculous lesions were found in each of these cows after death.

The fact that such a large proportion of the cows in Her Majesty's dairy herd had become tuberculous illustrates a point which it is all important to keep in mind in devising measures for the prevention and suppression of the disease. The premises in which these cows were kept are probably the best in the kingdom from the point of view of cubic space, light, and ventilation, and in respect of cleanliness they left nothing to be desired. Nevertheless, the disease had attacked thirty-six out of the forty animals. From this it may be inferred that tuberculosis among dairy cattle cannot be successfully attacked by simply insisting upon a cubic capacity of 800 feet per animal in the cow-sheds. There is only one way of keeping housed cattle free from tuberculosis, and that is to see that no tuberculous animal is admitted among them. That plan has been adopted in creating a new dairy herd at Her Majesty's Home Farm, all the animals purchased for it being tested by tuberculin and admitted only when they do not react.

<sup>1</sup> It will be observed that in No. 31 the temperature reached 103·4°, but this was at the sixth hour only, and the rise was obviously accidental.