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THE TRANSMISSIBILITY OF BOVINE TUBER-
CULOSIS TO MAN.¹

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Diseases, Berlin.

IN what I am about to say I shall confine myself strictly to the subject set down for discussion, namely, the transmissibility of bovine tuberculosis to man, and I shall not follow the example of most of the previous speakers, who have, on the contrary, concerned themselves with the question of the transmissibility of human tuberculosis to cattle. It would lead me too far if I were also to consider that question on the present occasion, but I reserve to myself to discuss it when I have published my further investigations regarding human and bovine tuberculosis.

For the most part I agree entirely with what was said by the gentleman who opened the discussion (Dr Köhler). In particular, it also appears to me that the statistics hitherto collected regarding primary intestinal tuberculosis are too uncertain, and beset with too many contradictions, to justify one in accepting them as decisive evidence.

According to Woodhead,² Still,³ and Shennan,⁴ this form of tuberculosis is especially frequent in England. However, there are not lacking English reports which indicate that primary intestinal tuberculosis is less frequent in that country (Carr⁵ met with only five cases

¹ A lecture delivered at the International Conference on Tuberculosis in Berlin, October, 1902. Translated from the *Deutsche med. Wochenschrift*, 1902. No. 48.

² "Lancet," 14th July 1888.

³ "Brit. Med. Journal," 19th Aug. 1899.

⁴ "Scottish Med. and Surg. Journal," Sept. and Oct. 1901.

⁵ "British Med. Journal," 19th Aug. 1901.

among fifty-three tuberculous children, and according to Coutt's¹ cases are very seldom met with).

In New York, according to Bovaird,² out of 369 tuberculous children 5, or 1·4 per cent., were affected with primary intestinal tuberculosis. In Boston, on the other hand, Councilman³ found the percentage 37·1.

So far as I can judge from an examination of the literature on the subject, and from my own personal information, all German authors agree in declaring that with us primary intestinal tuberculosis is of very seldom occurrence. The only exception to this is furnished by Kiel, where Heller found 37·8 per cent. of primary intestinal tuberculosis among the tuberculous children which he submitted to *post-mortem* examination.

As bearing on this matter, I may mention the following facts. A year and a quarter ago, at my instigation, an official request was addressed to the heads of all the University Cliniques in Prussia, asking that any cases of primary intestinal tuberculosis which appeared to be ascribable to the use of the milk of tuberculous cows might be placed at my disposal. Eight months ago the same request was sent to the Directors of the Pathological Institutes at the Prussian Universities with reference to primary cases of tuberculosis of the intestine, mesenteric glands, and peritoneum, in which the clinical history or any special fact pointed to the use of some tuberculous article of diet as the cause of the disease. A special request of this nature was addressed to Herr Heller, in Kiel. From that time up to the present I have not received from any of these sources a single report, and I therefore feel justified in concluding that within that time there has not been observed in the Institutes of any of the Prussian Universities a case of primary intestinal tuberculosis which could be ascribed to the consumption of tuberculous diet.

Before the request to which I have referred had been sent out, Virchow had placed at my disposal a case of primary intestinal tuberculosis, and he, at the time, expressly stated that such cases did not occur frequently in his Institute—only about three or four times in the course of a year. I may remark, in passing, that this was the same case to which Herr Wolff has referred to in the course of the discussion. He alleged that with tuberculous material from this case he had been able to infect an animal of the bovine species with tuberculosis. My investigation of this case led me to a precisely opposite result, for the pure culture of tubercle bacilli which I obtained from it proved to be completely avirulent for the ox. I cannot at the present time discuss the reasons why Herr M. Wolff and I have arrived at such contradictory results. I must reserve the discussion of that matter for another occasion.

There must, of course, be some explanation of the before-mentioned striking discrepancies in the statistics regarding primary intestinal tuberculosis. It appears impossible to ascribe them to local differences; at least, in spite of numerous inquiries, I have not been able to find that with respect to this matter there is any difference between Kiel and the rest of Germany. There therefore remains hardly any

¹ "British Med. Journal," 10th Aug. 1901.

² Bovaird: Primary Intestinal Tuberculosis in Children. "Archives of Pediatrics," 1901. Vol. XVIII., No. 12.

³ Councilman, Wallory, and Pearce: "Diphtheria." Boston, 1901.

other explanation than that very different opinions are held as to what constitutes primary intestinal tuberculosis, with the result that many employ the term to cases which others would not admit to be of that nature. As long as agreement has not been arrived at with regard to this point it will certainly be difficult to accumulate statistics which will be on all hands recognised as reliable.

The recorded observations regarding infection of the skin among veterinary surgeons, butchers, and workers in slaughter-houses, are not quite so contradictory. There are now available a good many reports regarding such cases, and I have myself repeatedly had the opportunity to examine cases of the kind.

All these cases have in common the history that, after the infliction of some wound on the hand or arm while cutting up a tuberculous animal, wart-like formations have developed on the skin—the so-called *tuberculosis verrucosa cutis*. In those rare cases in which the wound involves a tendon the result may be an inflammation of the tendon sheath. In occasional cases the process even appears to extend to the nearest group of lymphatic glands. In other respects the disease remains localised, and does not lead to a tuberculosis of the internal organs, but runs with the course of an unimportant skin disease, which, as workers in slaughter-houses have assured me, frequently heals of itself.

Hitherto there has only been one accepted case of this kind in which a general infection took place. This is a case reported by Pfeiffer of a veterinary surgeon who, a year after he had wounded himself on the finger, developed pulmonary tuberculosis, which ended fatally after other eighteen months. At the *post-mortem* examination the axillary glands were found to be free from tuberculosis, from which one is bound to conclude that there was no connection between the infection of the finger and the tuberculous infiltration of the lungs. It was merely a case of accidental co-existence of a localised tuberculosis of the skin (assuming that that was the nature of the skin disease, although even that was not proved), and a pulmonary infection which had a different origin. In view of the extraordinarily frequent occurrence of primary tuberculosis of the lung, it may well happen that that form of the disease may co-exist along with a verrucose tuberculosis of the skin.

Recently a new case of this kind very nearly slipped into the literature of the subject. In this instance it was alleged that a veterinary surgeon cut his forefinger while making the *post-mortem* examination of a tuberculous cow, and that, in consequence of this, he developed phthisis and died from hæmoptysis. But inquiries which were promptly instituted elicited the fact that the patient came of a tuberculous family, and that he had shown undoubted symptoms of pulmonary tuberculosis before he wounded his finger.

The case reported by Hartzell¹ will also not bear the slightest investigation. The history of this case is that a workman, while engaged in repairing a cattle truck, wounded the back of his hand, in consequence of which he developed a tuberculosis of the skin and died a year later of pulmonary tuberculosis. But there is not the slightest proof of any connection between the two infections, and it is not even mentioned whether a *post-mortem* examination was made.

¹ Ravenel, "The Intercommunicability of Human and Bovine Tuberculosis," 1902, p. 18.

In the same article Ravenel cites the case of Mr Walley, who is alleged to have died in consequence of infection contracted while making a *post-mortem* examination of a tuberculous cow, but the evidence in this case is still flimsier.

With the best of intentions it is impossible to decide this question on the evidence contained in such defective reports as these. On the other hand, I consider the facts recorded by Baumgarten regarding the inoculation of cancer patients with virulent bovine bacilli as very important. In that case the experiment was in every respect and throughout the whole of its course reliable; and, inasmuch as it may be assumed that there is no antagonism between carcinoma and tuberculosis, the only conclusion that can be drawn from the negative result of the experiment is that the culture of bovine bacilli in question had no virulence for the human subject when injected under the skin.

It must be perfectly evident that in all the attempts to solve the question of the transmissibility of bovine tuberculosis to the human subject by means of statistics relating to primary intestinal tuberculosis, and through observations on skin infection in man, we are dealing only with indirect evidence. In the most favourable cases included in such statistics we may know that they were genuine cases of primary intestinal tuberculosis, but we do not know for certain that they were caused by infection from bovine tuberculosis, rather than from human tuberculosis, although in every case the latter possibility must be taken into account, in view of the extraordinarily wide distribution of the disease in the human subject.

In the same way the occurrence of cases of localised infection with bovine bacilli in consequence of wounds of the skin in no way proves that these bacilli are able to infect the uninjured mucous membrane of the intestine, or, in the event of their being able to pass through the membrane without causing any trace of disease in it, to set up tuberculous disease in the mesenteric glands, and to lead to a general infection of the body, with its well known and rightly dreaded consequences.

On the other hand, if infection through the use of tuberculous meat and milk were as common as it is asserted to be, cases of the kind could not escape direct observation. In my opinion this aspect of the question has not hitherto received the consideration that it deserves, and it is absolutely necessary that we should for once turn our attention in that direction. There are not lacking circumstances that are in this connection analogous. There are various other diseases which may also be transmitted to the human subject by means of meat and milk, and the circumstances connected therewith are very instructive with regard to tuberculosis. In this connection I may cite as an example the so-called meat-poisoning, which is in large part caused by bacilli resembling those of typhoid; also the infection of human beings through the consumption of the flesh of animals dead from anthrax. Milk may even occasionally contain typhoid bacilli and then be the cause of typhoid infection, as has frequently been observed in recent times.

It is extremely characteristic of all such infections through meat and milk that they do not occur as single cases, but as smaller or larger outbreaks. It is impossible that this could be otherwise, since

the milk of a cow or the flesh of a diseased animal is almost always partaken of by several persons, and, indeed, often by a great many. Not the whole of such persons, but a larger or smaller proportion of them, become affected and visibly ill.

In consequence of the number of persons attacked, attention is drawn to the infection and to the common cause of the attacks; and, furthermore, the incontrovertible proof is thereby furnished that the article of diet in question must have contained the infective material. In such circumstances neither statistics nor animal experiments are necessary, since the facts observed furnish the direct proof that the disease was caused by the consumption of the infected article of diet.

Now, the tuberculous infection must behave in the same way if tubercle bacilli virulent for the human subject are found in meat or milk. Here also a certain percentage of the human beings who have partaken of the infected article of diet must become ill, and the cases must occur in groups.

It is true that in tuberculosis the circumstances will be different from those observed in typhoid, for, owing to the much longer period of incubation in the former, the cases of illness will not appear so soon after the act of infection, and they will not appear to be so close together in point of time as in typhoid. But, on the other hand, the tuberculous infection will be favoured by the fact that in the case of those persons who consume tuberculous articles of diet the infection will be frequently repeated, and will be spread over a long period of time, in consequence of which the chances of infection actually taking place will be notably increased.

It will thus be seen that everything speaks in favour of the view that if tuberculosis can actually be caused by the consumption of the flesh and milk of tuberculous animals, the resulting cases must appear in groups; and the next question that arises is whether such occurrences have not already been observed and described.¹

Let us examine in the first place the published observations regarding infection through the consumption of the flesh of tuberculous animals. And at the outset I would like to call attention to the fact that it is not, as has often been assumed, only tubercle-free flesh, or such flesh in the boiled or well roasted condition, that is consumed. An authority on meat inspection—Ostertag—says, with regard to this point, that “innumerable tuberculous organs are daily sold and consumed.”² For the most part these are made up into sausages. Only a short time ago I had myself to appear as a professional witness in a legal case, in which it was merely by accident that some tuberculous flesh was not taken to the shop of a butcher (certainly without his knowledge), where it would have been used for the making of sausages.

Although there thus cannot be any doubt that until recently,

¹ I may mention that B. Fraenkel has called my attention to the fact that prior to the discovery of the tubercle bacillus he had given expression to this view in his article on tuberculosis in Gerhardt's text-book on the diseases of children. He there expressed the opinion that tuberculosis could not be transmitted through the milk of tuberculous animals, and gave as his reason for so thinking that he had never known several children in the same family to be simultaneously attacked with tuberculosis, as must necessarily have occurred if the common milk jug had contained the cause of the disease. Compare B. Fraenkel: Remarks on the Prophylaxis of Tuberculosis and the Isolation of Consumptives, “*Berliner klinische Wochenschrift*,” 1901, No. 38.

² “*Handbuch der Fleischbeschau*,” 1899, p. 646.

owing to the defective inspection of meat, a very large quantity of tuberculous flesh was brought into the market, and that even now such flesh is frequently enough consumed, nevertheless there has not yet been recorded anywhere a single instance of the simultaneous infection of a number of individuals in consequence of their having eaten tuberculous flesh. On the contrary, several authors have reported facts which prove exactly the opposite. According to Bollinger,¹ inquiries which were made by the Bavarian Government in 1879 elicited some observations that went to prove that the flesh of tuberculous animals was harmless. There were found many families, and even whole villages, in which it was the custom to use tuberculous flesh, and tuberculosis was not more frequent among these than elsewhere.

Exactly similar observations have been made by Goering² and Schottelius.³ Consequently, a very moderate view is generally held with regard to the degree of danger attaching to tuberculous flesh. At the Tuberculosis Congresses in Paris in 1885 and 1891 it was resolved that the entire carcasses of tuberculous animals should be condemned, but at the Congresses of 1893 and 1898 a rational view of the matter was taken, and the sale of the flesh of animals affected with a localised tuberculosis was considered permissible. The International Congress for Hygiene in London was also unanimously against the total condemnation of tuberculous carcasses.

Ostertag, who is an energetic defender of the identity of bovine and human tuberculosis, in his text-book on meat inspection (1899) says: "In view of the rare occurrence of primary intestinal tuberculosis in the human subject, and the great prevalence of tuberculosis among cattle, only a very slight degree of danger for man can be ascribed to the flesh of tuberculous animals."

This is the position that has also been taken up by the highest authority in Prussia. The following occurs in an Order issued by the Minister for Internal Affairs Agriculture, etc., on 26th March 1902: "In view of the fact that attempts that were made on a large scale and continued for a year, at the Berlin Veterinary School and at several Prussian universities, to infect animals by feeding them with the muscular tissue of tuberculous cattle, have had an essentially negative result (opinions of the Scientific Deputation for Medical Affairs of 1st December 1886), and since the transmission of tuberculosis, even through the use of flesh containing tuberculous nodules, has not been proved, the flesh of animals in good condition, even when (tuberculous) disease is present, may, as a rule, be considered as of undiminished value, and the sale of the same need not be subjected to any special police supervision."

From all this it will be seen that there is a complete lack of evidence to show that tuberculous flesh is dangerous, or, as the Ministerial Decree expresses it, the danger is "not proven." But nobody will deny that the tubercle bacilli found in flesh are identical with those that occur in milk, and there is something entirely contradictory in the fact that recently a much more serious estimate has

¹ "Ostertag," loc. cit., p. 646. Bollinger, "Deutsche Zeitschrift für Thiermedizin," Vol. I., p. 242, and Vol. II., pp. 138 and 279.

² Goering: Die Verbreitung der Tuberkulose des Rindes in Bayern. "Deutsche Zeitschrift für Thiermedizin," Vol. VI., pp. 142 and 290.

³ Schottelius: Zur Kritik der Tuberkulosefrage. "Virchow's Archiv," Vol. XCI., p. 129.

been formed of the danger attaching to the milk of tuberculous animals than of that which attaches to their flesh.

What now are the facts with regard to the direct evidence as to the danger attaching to the milk of tuberculous animals?

The bovine tubercle bacilli present in milk are also widely distributed, and they are much more frequently consumed in the living condition than is generally supposed. In the first place, it must be remembered that 1 to 2 per cent. of all milch cows are affected with tuberculosis of the udder, and, without exception, furnish milk which contains more or fewer bacilli. But mammary tuberculosis is not of such a nature that it can be recognised in its very earliest stages. At the time when the disease first attracts attention, and a comparatively certain diagnosis is possible, the condition has already been in existence for weeks, or even for months, and during the whole of that time the milk with its tubercle bacilli has been consumed. Furthermore, the use of such milk is practically never confined to one person. As a rule, this milk is mixed with that from several other animals in the same herd, and it is partaken of by a large number of people. If the milk is sent to a creamery it may be distributed to hundreds of consumers. With regard to this latter possibility, I cannot share the view expressed by M. Nocard, namely, that dilution renders the milk less infective, and the tubercle bacilli eventually inoperative. This view would be right if we were dealing with a poison in solution, but we have here to do with micro-organisms, which cannot be diluted, but merely more widely distributed, with the result that they are brought into contact with a proportionately larger number of people, and, if they are virulent for these, the danger must be in the same measure increased.

Now, in this connection it is customary to take comfort in the thought that boiling of the milk destroys the tubercle bacilli in it. That, however, is a mistake. It is true that when in a laboratory experiment milk is brought to the boiling point all the tubercle bacilli in it are destroyed, but in the circumstances in which milk is heated for domestic purposes they remain alive. At my instigation Professor Beck¹ has carried out many careful experiments on this point in the Institute of Infectious Diseases, and he has found that by simple boiling of the milk in a vessel with a wide mouth, which is the treatment ordinarily accorded to household milk, the tubercle bacilli are not destroyed. In order to destroy the bacilli a uniform boiling for several minutes is required, and the housewife objects to this procedure because it is apt to cause the milk to boil over or become burnt. Hence, when anyone asserts that he has never consumed living bovine tubercle bacilli, because he drinks only milk that has been cooked, it still remains for him to show that the milk which he has used has on every occasion been kept boiling for several minutes.

One cannot even trust entirely to the sterilising apparatus employed by the large milk companies. So long as these instruments are used according to the directions, and carefully supervised, they will in most cases fulfil their purpose; but as soon as there is any failure in this supervision, even although it be of a transient nature, then any in-

¹ Beck: Experimentelle Beiträge zur Untersuchung über die Markt-milch. "Deutsche Vierteljahrsschrift für öffentliche Gesundheitspflege," 1900, p. 430.

fective material that is present slips through uninjured, as has been proved by the numerous typhoid cases which have had their origin in milk companies.

There is still another point to which I would like to call attention, and it is one that is almost always left out of account in discussions regarding tuberculous milk. We have to consider not only the milk, but also the products which are obtained from it, and especially the butter, which has very frequently been proved to contain living tubercle bacilli. I have frequently found that persons who passionately declare that they have for years drunk only boiled milk, owing to a fear of contracting tuberculosis, when asked what they have done with the butter, confess that it had never occurred to them that that also ought to have been sterilised.

In these circumstances I believe that I am justified in asserting that almost everyone in the course of his life has more or less frequently ingested living bovine tubercle bacilli, and in numbers that are not so very small.

If bovine tubercle bacilli are actually dangerous to the human subject, one would consequently expect that cases of illness unmistakably attributable to the use of tuberculous milk must have been observed and described with extraordinary frequency. Now, I have searched the literature for such cases, and I think I may assert that nothing important has escaped my notice. But instead of the innumerable cases which one would have expected, I have been able to find only two instances in which a group of individuals were attacked, and twenty-eight separate cases. We must now examine these, in order to see whether they constitute evidence that is free from any doubt.

The first case is the celebrated and frequently cited one which Ollivier brought before the Academie de Medecin on the 24th February 1891.

In the course of a few years thirteen pupils at a girls' boarding school contracted tuberculosis, and six of these died from the disease. In several of these cases the tuberculosis appeared to have had its starting-point in the intestinal canal. When a search was made for a cause of these cases, it was found that a cow belonging to the establishment had for years been affected with tuberculosis of the udder, and that its milk had been consumed by the pupils. It looked, in fact, as if this was a group of cases caused by the use of tuberculous milk, and an indubitable case of bovine infection had thus been discovered. This, indeed, was Ollivier's opinion, and also the opinion of all those who in recent times have regarded the case as a classical example of infection through tuberculous milk. This case, however, is by no means so free from uncertainty as has generally been supposed, for, apart from the fact that only one *post-mortem* examination appears to have been made, and the intestinal tuberculosis was diagnosed on somewhat uncertain grounds, it has been concluded that the only other possible source of infection was heredity. A direct infection from human being to human being has apparently never been taken into consideration, and yet the course of this small endemic of tuberculosis might have been exactly the same if one of the pupils or teachers had been the subject of tuberculosis, and infected a number of those living with her by means of her sputum.

Something of the kind has often happened, and under all the circumstances it ought to have been considered. But, apart from this, the alleged classical case dissolves into nothing, or indeed becomes the very opposite of what it appeared to be, in consequence of a second report which Ollivier felt himself obliged to make to the next meeting of the Academie owing to his having acquired better information. That is to say, he felt obliged to explain that he had made a mistake, and that the milk of the cow in question had been consumed not by the boarders, but by the teaching staff and servants of the establishment. Among the latter, who had regularly consumed the suspected milk, not a single case of tuberculosis had occurred. The fact that, in spite of this correction, Ollivier's case is still always cited as proof of the identity of human and bovine tuberculosis shows in what a one-sided and uncritical way the supporters of that theory make use of evidence.

I come now to the second example of a group of individuals being infected. An account of this case was published some months ago by Huls in the *Münchener medizinische Wochenschrift*, and it has been referred to already in the discussion. In a family of the name of Müller, comprising nine persons, who, it is alleged, had for years consumed milk, butter, and meat from tuberculous animals, and who were not exposed to any other risk of infection, seven members died from consumption. But in this case one only needs to observe the order in which the deaths followed one another to see immediately that the connection between them is quite different from the one put forward by Huls. The first to be attacked was the mother, but she recovered after some months. In the following year the youngest child was attacked and died. In the same year a son, aged eighteen years, became ill, and also died. A year latter another son, aged twenty-three years, followed in the same way. In the following year the mother again became ill, and died. Then followed in succession a daughter, aged sixteen years, the father, and a third son.

That under the circumstances here indicated there was no opportunity for the operation of infection from human being to human being, through contact and the living together of the diseased and the healthy, is to my mind incredible. Everyone acquainted with infectious diseases will at once acquire the conviction that in this case there was a continuous chain of infection by contact, and that it is not an example of a group of persons having been infected through a common diet. In order to make the latter view tenable, the cases ought to have occurred in the course of half a year, or a year at the most; they could not have been spread over a series of years, as they were in this case.

As an example of infection of a group of persons, this case also falls to the ground, and there remain only the twenty-eight cases in which patients were attacked singly.

No great confidence can be placed in these cases. Would a single case of typhoid after the use of suspected milk be accepted by itself as sufficient proof? Certainly not. Nevertheless, I do not wish to and cannot dispute that single cases may occur. But, in order to be convincing, they must fulfil the following conditions:—

1. Positive proof that the disease was really tuberculosis must be

furnished, and, if possible, the starting-point of the disease must also be established. To this end we must have in the case of adults indisputable clinical symptoms, or, when these are not present, a *post-mortem* examination. In the case of children the latter is indispensable, as in them the clinical symptoms are too uncertain.

2. Other sources of infection must with certainty be excluded. The assurance that the patient came of a healthy family will not in any circumstances suffice. There are many other possibilities of infection, both in the family and outside of it, which in the case of every human being must be taken into consideration. In this connection I can only confirm the reference of previous speakers to the investigations of Preisich and Dieudonné with regard to a very noteworthy source of infection in children, in the shape of tubercle bacilli in the dirt of their finger nails.

3. In every case of alleged infection through the use of tuberculous milk the history of all the other persons who have partaken of the milk must be taken into consideration. These other persons form, so to speak, a control experiment; and when, out of a large number of people who have partaken of the suspected milk at the same time, only one becomes ill, the fact speaks decidedly against the supposition that that one person was infected by means of the common article of diet. Even in the case of typhoid any suspicion attaching to the milk would immediately be dismissed if it were found that out of all the persons who had partaken of the milk only one had suffered from typhoid.

4. The source of the milk must also receive attention. Seeing that it has in recent years become increasingly clear that the milk of tuberculous cows does not contain tubercle bacilli unless the udder is involved in the disease, one can no longer accept the fact that a person has consumed milk from a tuberculous cow as proof that bovine tubercle bacilli have actually gained access to his alimentary canal. It may well happen that a person consumes tuberculous milk without being brought into contact with bovine tubercle bacilli. The milk must be from a cow with a tuberculous udder, and the fact must be noted in any report regarding milk-infection that pretends to be complete.

When I now examine the twenty-eight isolated cases which I have collected from the literature, in order to see how far they conform to the conditions just laid down, I arrive at the following result:—

In only ten cases is it mentioned that a *post-mortem* examination was made, and only seven of these are said to have been cases of intestinal tuberculosis.

In only three cases is it stated that the milk came from a cow affected with tuberculosis of the udder.

In no single case were the other possibilities of infection certainly excluded. As a rule only the absence of heredity is given, although we know that this plays a very subordinate rôle, if any rôle at all.

In no case is anything reported regarding the other persons who partook of the milk.

The insufficiency of this evidence has not entirely escaped the notice even of those who make use of it.

Thus, Ravenel¹ says: "The number of cases in which the infection

¹ Loc. cit.

can be ascribed to the use of tuberculous milk is not great,¹ and almost all of them are open to the objection that all other sources of infection cannot be completely excluded."

And in the report of a Committee of the American Public Health Association,² which, moreover, is distinguished by the strikingly partisan standpoint which it takes up, it is admitted that in the reported cases one does not know whether the disease was caused by bovine bacilli or not. But, in spite of this admission, the collected cases are dealt with as if that had been established beyond a doubt.

It therefore appears to me to be necessary to refer briefly to some of these cases, including those which are regarded as quite certain, and which have therefore acquired a certain notoriety.

I begin with the Gosse case, an account of which has been published by Nocard.³

Dr Gosse, a surgeon in Geneva, was in the habit of taking his family every Sunday to a farm, where his seventeen-years-old granddaughter liked to drink milk fresh from the cow. This young girl, after a long illness, died from intestinal tuberculosis, as was proved by the *post-mortem* examination. An investigation which was then instituted brought to light the fact that five of the cows at the farm were tuberculous, and that two of these had tuberculosis of the udder. This was held to be sufficient to justify the assertion that the disease and the death of the girl must have been caused by the tuberculous milk. The possibility of infection in other ways is not even mentioned, although the fact that she constantly resided in the town must undoubtedly have provided opportunity for other methods of infection. We must further ask, What became of the other people who drank the rest of the milk at this farm? Those who resided at the farm must certainly have done so. Did none of them become ill? If any of them had, the fact would have been immediately reported, and since that was not done we may assume that no one except the girl became ill, which again compels us to draw the logical conclusion that the milk in question was not dangerous to health, and cannot be accused of having caused the death of Dr Gosse's granddaughter.

M. Nocard, who has introduced this case into the literature of bovine tuberculosis, considered that it had almost the value of an experiment. I do not believe that that distinguished authority on tuberculosis, who knows quite well with how many precautions, and with what care, a tuberculosis experiment must be carried out in order to satisfy the present-day scientific requirements, will still maintain this claim.

The case observed by Dr Stang in Amorbach is even less convincing than the one just discussed. It has been described by Bollinger.⁴ A five-years-old boy suffered from abdominal dropsy and died with the symptoms of consumption. The *post-mortem* examination revealed tuberculosis of the abdominal lymphatic glands, and also of the serous membrane and lungs. With respect to the etiology, it was ascertained that there had been no tuberculosis in the family for two generations, and that the boy had for years been drinking the

¹ It would have been more correct to say, "is beyond all expectation small."

² "Relation of bovine tuberculosis to the public health," Washington, 1901, p. 22. Published by the U.S. Department of Agriculture.

³ Nocard, "Les tuberculoses animales," p. 124.

⁴ "Deutsche Zeitschrift für Tiermedizin," Vol. II., p. 281.

milk of a tuberculous cow. This case also, Bollinger says, may be compared to an experiment. But in addition to the objections that were raised against the preceding case, there is here added the fact that we are not informed whether the cow was the subject of udder tuberculosis or not. Furthermore, besides tuberculosis of the mesenteric glands and peritoneum, the boy had tuberculosis of the lungs. It ought to have been determined whether the latter was not the primary disease, as is often the case.

The frequently cited case reported by John¹ was that of a boy aged two and a half years, who, in consequence of measles and pulmonary catarrh, had lost condition, and who died from miliary tuberculosis of the brain. He had been fed with milk from a tuberculous cow. Whether a *post-mortem* examination was made, whether other possible sources of infection were considered, whether the cow was the subject of tuberculosis of the udder, or whether other persons who partook of the milk were attacked, is not stated.

In the case reported by Uffelmann² a child which had been fed with uncooked milk from a diseased cow developed tuberculous nodules in the subcutaneous tissues and died. Neither the child nor the cow was submitted to *post-mortem* examination. Uffelmann himself does not regard the case as at all convincing, but, nevertheless, it is constantly cited as a practical illustration of the dangerous character of the milk of tuberculous cows.

Some authors (Göring³ and Schoengen⁴) even allege that when children were fed with the milk of a tuberculous cow they became ill, developed skin eruptions, and had a cough, but recovered as soon as they were given milk from healthy cows. Of course such cases prove exactly the opposite of what is intended—namely, that children may for a long time consume milk from tuberculous cows without becoming tuberculous.

All the other recorded cases are similar to those just considered. The result we thus arrive at is that, just as in the case of tuberculous flesh, no one has yet been able to bring forward a single observation that is free from doubt to prove that tuberculous milk is dangerous to health, although innumerable persons are constantly exposed to the alleged danger.

But, just as with regard to the flesh, there are on record observations which show that human beings have for long periods consumed tuberculous milk without any ill effect. The reports with regard to this point are certainly not numerous, apparently because it was much more interesting to search for examples of infection, whereas people did not trouble themselves about the non-occurrence of infection.

Nevertheless, it would be easy to collect in a short time material that would be useful. All that would be necessary would be to search in the country, where the facts are open to observation, for undoubted cases of tuberculosis of the udder; and to ascertain how long the disease has been in existence; what persons, and especially children, have consumed the milk or the butter; whether the milk

¹ John, "Geschichte der Tuberkulose," p. 57. Leipzig, 1883.

² "Archiv. für Kinderheilkunde," Vol. I., p. 414. 1880.

³ "Deutsche Zeitschrift für Theiromedizin," Vol. VI., p. 142.

⁴ Dissertation by Behrens, "Über primäre tuberkulöse Darminfection des Menschen." Berlin, 1894.

was boiled; whether the persons in question within a year or two became ill from tuberculosis; and, if so, the form of the disease.

During recent years I have received very many letters from persons who inform me that they or the members of their families have for longer or shorter periods drunk tuberculous milk and yet remained healthy. However, since it is not now possible to verify these cases, I will not go further into them.

At the same time, I would beg the International Committee to use its influence in the direction of collecting trustworthy observations, to take the place of the entirely useless material at present available, viz. :—

1. Cases of alleged infection through the use of tuberculous milk, attention being paid to the conditions previously laid down (*post-mortem* examination, exclusion of other sources of infection, history of the other persons who partook of the milk, proof that the udder was tuberculous).

2. Cases in which infection did not occur after the use of tuberculous milk, again under the specified conditions (proof that the udder was tuberculous, observation of the persons for a sufficient time, information as to whether the milk was boiled or not).

In the meantime, we can only say that the injurious effect of tuberculous milk and its products has not been proved.

What that fact indicates, in view of the uninterrupted opportunity for infection, I will leave to everyone to judge for himself.

It need hardly be said that this is intended to apply to human beings only. It is the business of agriculture and veterinary science to determine the extent to which tuberculous milk is injurious to cattle, and the regulations that ought to be enforced to combat the danger, if it exists.

At the present time there is no ground for making general regulations with regard to the flesh and milk of tuberculous cattle, as a means of combating human tuberculosis. Besides, such regulations would be very costly on account of the compensation that would have to be paid for condemned animals, and because of the immense quantity of milk that would have to be supervised. It is decidedly better to spend this money in carrying out such measures as will certainly lead to a decline in human tuberculosis, rather than to employ it against a danger that has not been proved to exist.

In this connection I can only repeat what I said in my London lecture: In our efforts to combat tuberculosis it is important that we should not lose ourselves in wrong paths if success is to be achieved. Our object must be to stop up the chief, indeed one may say almost the only, source of infection. That source lies in those consumptive patients who, in consequence of the unfavourable conditions under which they live, or because they are obstinately opposed to the simplest precautions against the spread of the infection, constitute a danger to their surroundings. These patients must in some way or other be taken care of, either by placing them under more favourable conditions, such as house accommodation, or by bringing them into appropriate institutions, so that they may cease to be a danger to their neighbourhood.

According to the experience gained in connection with other infectious diseases, we must acquire the conviction that it is only in

this way that anything is to be achieved; and I would therefore earnestly advise that in the future this task should be kept more in the foreground of the struggle against tuberculosis than it has in the past.

RINDERPEST IN SOUTH AFRICA.

By DUNCAN HUTCHEON, M.R.C.V.S., Colonial Veterinary Surgeon to the Government of Cape Colony.

FROM ancient literature on the subject, this bovine plague must have existed in the steppes of Oriental Europe and of Central Asia, since the most remote periods; and from these centres it has gradually spread by wars and the migrations of people to almost every country in Europe, but information on this subject can be obtained from such works as Fleming's Sanitary Science and Police; Gamgee on Cattle Plague, etc. The following is a brief account of the origin of the disease in Central Africa and its spread to the South African States and Colonies.

ORIGIN OF THE DISEASE IN CENTRAL AFRICA.

Sir John Kirk, writing to *Nature*, 10th June, 1896, says "That there can be little doubt that the present epidemic, known under the common name of rinderpest, is the same as that with which we have been familiar in Central Africa for the past six years, commencing—so far as we know—in Somaliland in 1889, where the disease killed off a large part of the cattle. It passed through Masailand in the autumn of 1890. It was there that Captain Lugard, then an officer of the Imperial British East African Company, first came in contact with it."

Dr Edington states (*vide Agricultural Journal* of 14th May 1896) that Africa has been infected "and for a very long time the disease was resident in, and around Lower Egypt. The malady had entirely disappeared from this region, however, when, in 1890, it was imported by an animal which was sent to the Italian troops at Massowah (!) thence the disease passed down the Nile with the Arabian caravans."

Captain Lugard, in his work on the "Rise of our East African Empire," says:—"The plague seems to have started on the east coast, opposite Aden, and to have spread inland. It began at the end of 1889, and when I went into the interior in December of that year, it had not reached Masailand and Ukamba, nor yet in the spring of 1890. When I returned up country in the autumn of 1890, it had spread through these countries, and the cattle and buffalo were dead. It had preceded me through Kavirondo and Uganda, though—when Mr Jackson passed down in the summer of 1890—it was only beginning to show effects. Beyond Uganda, I found it had just preceded me through Ankoli and Unyoro; and in the far heart of Africa at Kavalli, it had swept off every ox only a few weeks before I arrived (September, 1891). Passing southwards, it reached the north of Nyara about July, 1892." Sharpe, quoted by Lugard, says:—"Shortly before August, 1892, the district to the north of the Nyassa had been