Report to the Local Government Board on the preparation and storage of glycerinated calf vaccine lymph : with an introduction by the Medical Officer.

GLYCERINATED CALF VACCINE LYMPH.

REPORT

TO THE

LOCAL GOVERNMENT BOARD

ON THE

PREPARATION AND STORAGE

OF

GLYCERINATED CALF VACCINE LYMPH;

WITH AN INTRODUCTION BY THE MEDICAL OFFICER.

Presented to Parliament by Command of Her Majesty.

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TO THE RIGHT HONOURABLE HENRY CHAPLIN, M.P.
PRESIDENT OF THE LOCAL GOVERNMENT BOARD.

SIR,

SHORTLY after the issue of the Report of the Royal Commission on Vaccination last autumn I received your instructions that I should, together with Dr. Monckton Copeman, visit certain cities in different countries on the continent of Europe, with a view of obtaining information as to the methods adopted, by the respective authorities and others concerned, in the distribution of vaccine lymph derived from the calf, more especially in reference to the preparation, storage, and distribution of glycerinated calf lymph.

The necessary visits were commenced in December of last year, but owing to the fact that in some of the countries to be visited public vaccination is practically limited to certain months of the year, commencing with the spring, it was found impossible to complete the inspections until quite recently. In eliciting information as to the methods adopted in each of the countries visited, we held especially in view two points to which the Royal Commission gave prominence in their Report. The first of these—one which the Commissioners put "in the forefront"—is the recommendation in section 437 of their Report "that parents should not be required to submit their children "to vaccination by means of any but calf-lymph." The second, which is referred to in section 448, is concerned with experiments which Dr. Copeman made and announced to the International Congress of Hygiene which met in London in August 1891, as to the effect of the storage of vaccine lymph in glycerine. "The conclusions at which he arrives," say the Commissioners, "are that the addition of glycerine, whilst it "leaves the efficacy of the lymph undiminished, or even "increases it, tends to destroy other organisms"; and they add that: "The question is one a further investigation of which is "obviously desirable."

The places visited by us were Paris, Brussels, Berlin, Dresden, Cologne, and Geneva; and in submitting to you an account of the operations which came under our notice in each of these cities, I beg leave to make the following observations.

It will be noted that in each of the countries concerned, vaccination with calf-lymph has become the habitual, if not the universal practice. In some, indeed, we were informed that although vaccination with humanised lymph is not definitely prohibited under any statute or regulation, yet resort to such lymph by any medical practitioner having official responsibility to the Government is altogether discouraged.

In only one of the places visited—namely, Paris—did we find that vaccination was carried out under official sanction with crude calf-lymph, and even there the process was limited to vaccination direct from calf-to-arm, all lymph stored for distribution being glycerinated calf-lymph.

The circumstances of Paris in the matter of vaccination direct from the calf deserve consideration, because they have a certain similarity to those which may be encountered in this country, in case the use of calf-lymph should become habitual. Thus we were informed that if vaccination had, during past years, been limited to the use of glycerinated calf-lymph, stored in tubes or otherwise, it would have been found difficult, amongst certain classes of a population which heretofore had only known of stored humanised lymph, to convince persons whose vaccination it was desirable to secure that the lymph proposed to be used on them was really calf lymph, not humanised lymph. In order to ensure confidence in this respect, it had been the practice to convey calves to the vaccination stations, or to districts infected with small-pox, and to perform the vaccination direct from calf-to-arm. Perusal of the account which we give as to this practice in the hands of MM. Chambon and Ménard will show that it has been brought to a position of very considerable efficiency.

In all the other countries visited we found that, acting on the indications announced by Dr. Copeman in 1891, the Governments and other authorities concerned had made sustained investigation as to the preparation, storage, and use of glycerinated calf-lymph, and had gradually come to adopt that preparation of lymph for official, and in some cases for all, purposes throughout their jurisdictions. Thus, in Germany we were informed that the system of vaccinating direct from the calf had come to be abandoned as completely as that from arm-to-arm, the use of glycerinated calf-lymph having become general throughout the Empire.

The reasons for this change have been two. The governing reason has been the confirmation by competent bacteriologists of the results obtained by Dr. Copeman, to the effect that, by the admixture to calf lymph of a 50 per. cent solution of pure glycerine in sterile water, and by subsequent storage of the lymph material in tubes, under due precautions, for a term of several weeks, the preparation remained quite active as vaccine, whilst a very remarkable germicidal effect was produced on extraneous micro-organisms in the lymph, even including certain pathogenic organisms which had been purposely added to the lymph material. The second reason was that, by reason of the admixture referred to, the amount of vaccine procurable from a given calf could be greatly, even enormously, increased, and that, within certain wide limits, this could be done without interfering with the insertion-success following on the use of the lymph. At the Board's Animal Vaccine Establishment it has hitherto not been deemed necessary, nor even expedient, to make one calf serve for more than some 200–300 vaccinations. It is no unusual thing abroad to provide from a single calf an amount of glycerinated lymph that shall serve for from 4,000 to 6,000 vaccinations, and in Berlin we were assured that the glycerinated lymph which was prepared in our presence from one calf would suffice

for no less than 15,000 vaccinations. We brought some of this Berlin lymph to England, and it was used for the purposes of vaccination at intervals of 9, 11, and 37 days after its collection, with the result that in 76 vaccinations performed, in each case by five insertions, its use resulted in a mean insertion-success of 92·0 per cent. Storage of this particular sample for a much longer period did not give satisfactory results. With other preparations of glycerinated lymph, diluted to about one third of the amount of the Berlin sample, and which were used in England at intervals varying from 7 to 31 days after collection and preparation, the insertion-success reached 97, 98, and 99 per cent.; and in the case of 111 vaccinations, all effected with two other supplies of glycerinated lymph, used at intervals of from 7 to 30 days after preparation, the success reached 100 per cent., every insertion of lymph being followed with success. In all these cases the vaccination was performed by means of five insertions.

In every instance we found that the work of collecting, preparing, and storing the glycerinated lymph was carried out with the greatest care; a condition of scientific cleanliness was especially aimed at, and a laboratory, fitted with bacteriological and other scientific apparatus, always formed an essential part of the vaccine institution. The extent to which the desired end of freedom from extraneous impurity was attained depended largely on whether a first attempt to adapt an existing calf station or similar establishment to its new purposes had been maintained, or whether it had been abandoned in favour of an institution constructed especially for the purposes of that which is in the main scientific laboratory work. Several of the stations which we visited are already under condemnation, because of the difficulty of ensuring that freedom from extraneous micro-organisms which should be aimed at during the preparation of the lymph supply; the Cologne station is one of the newest, and may well serve, in its main features, as a type of that which should be aimed at.

The condition of scientific cleanliness to which I have referred extended to such matters as the following: (*a*) the construction and administration of the stabling for the calves; (*b*) the means for washing or bathing calves before their vaccination; (*c*) the construction, cleansing, &c., of the operating rooms; (*d*) the cleansing of the vaccinated surface of the calf with germicidal preparations and sterilised cloths before collection of the lymph; (*e*) the use of clean sterilised outer garments by all officials concerned in the processes carried out; (*f*) the sterilisation of all instruments, &c., employed; and (*g*) the carrying out of the process of admixture of the lymph material or pulp with glycerine, as also its preparation and storage, under conditions of laboratory freedom from extraneous organisms.

Further, we found that it was an invariable practice at the stations visited on the Continent not to issue any lymph until a report had been received from a veterinary surgeon, after slaughter of the animal, as to the freedom of the calf furnishing

it from disease; in brief, the lymph issued is that of healthy calves only. This practice is mainly with a view of avoiding all risk of conveying tuberculosis along with calf-lymph; though such risk would, under any circumstances, be a very remote one, seeing that tuberculosis is extremely rare in young bovine animals, and seeing also that the tubercle bacillus, when experimentally added to a mixture of lymph and an aqueous solution of glycerine, rapidly loses its vitality.

The information which we obtained in the course of our visits does not profess to be complete. Much remains to be ascertained by careful scientific research, in order to learn what are the precise conditions under which glycerinated calf-lymph can be prepared and stored, so as to secure to the utmost freedom from extraneous, and especially from pathogenic micro-organisms, whilst at the same time retaining to the utmost the undiminished protective value of the lymph material against small-pox. We learned that in every country visited further research is being made in this direction, and in Germany a special Commission of medical and bacteriological experts has been appointed by the Government to study and report upon the subject.

But the information which is now available in this country, and that which, during the course of our visits abroad, was placed at our disposal with a readiness and a courtesy which calls for an expression of the fullest acknowledgment, suffices to enable me to submit the following conclusions for your consideration:—

1st. It is desirable that vaccination, both primary and secondary, carried out under the auspices of the Government, should be performed exclusively with vaccine lymph derived from the calf.

2nd. There will probably be advantage in retaining, for a time at least, the system of calf-to-arm vaccination at the Board's Animal Vaccine Station for such parents and others as may specially desire it, and for the purposes of comparing its results with those following the use of calf-lymph preserved in one or another way.

3rd. The distribution of calf-vaccine from the National Vaccine Establishment should be limited to glycerinated or similar preparations of lymph and pulp material, in air-tight tubes, or other glass receptacles.

4th. To give effect to the above, it will be requisite that the Board's Animal Vaccine Station should be reorganised, both as regards construction and administration. Notably will it be requisite that it should include a properly equipped laboratory, under the direct supervision of a bacteriological expert.

I have the honour to be,

Sir,

Your obedient servant,

July 1897. RICHD. THORNE THORNE.

REPORT on the RESULTS of an INSPECTION made by Dr. R. THORNE THORNE and Dr. S. MONCKTON COPEMAN as to VACCINATION ARRANGEMENTS adopted in certain EUROPEAN COUNTRIES with special reference to the PREPARATION and STORAGE of GLYCERINATED CALF VACCINE LYMPH. (Prepared by Dr. S. MONCKTON COPEMAN.)

PARIS.

At Paris we spent several days in inspecting the manner in which the work of obtaining, preparing, storing, and distributing calf vaccine lymph is carried out at the Institut de Vaccine Animale and at the Académie de Médecine respectively.

The *Institut de Vaccine Animale* is carried on by M. Chambon and Dr. St. Yves Ménard. It is, practically, a private establishment, although the municipality of the city of Paris contract with the directors to carry out all such public vaccinations, within their jurisdiction, as may be necessary.

The Institut de Vaccine Animale, which is situate in the Rue Ballu, consists of what was originally a dwelling-house, with a courtyard opening to the street alongside, and a stable behind, the portion of the courtyard immediately adjoining the stable being covered over and provided with sliding doors, so as to form an operating room when necessary. Rooms in the dwelling-house on the ground floor are set aside as waiting and operating rooms in which persons are vaccinated direct from the calf, while on the first floor are other rooms in which the calf lymph is manipulated, placed in sealed tubes, stored, and distributed.

Stable.—This is a building about 18 feet square, which contains stalls for 10 calves. Each stall is somewhat narrow, but we were informed that this was advantageous, as the animal was thus kept more quiet than would otherwise be the case. Attached to the halter of each animal is a large iron ring which runs on a vertical iron rod let into the wall of the building, above and below. This arrangement was devised in order to prevent the calves from being able to lick the inoculated area of their body, while, at the same time, it does not prevent them from lying down. The floor of the stable, which is formed of roughened bricks, slopes slightly to a shallow drain on either side of a footway between the two rows of stalls. The building is heated artificially by means of hot-water pipes, and its ventilation is aided by means of an extraction shaft containing a lighted gas jet. At the time of our visit the temperature was about 15° C. The walls are covered with glazed tiles, and the floor is laid with bricks which are impervious to moisture. Both walls and floor are occasionally washed down by the aid of a spray of a solution of perchloride of mercury.

Calves.—These animals, which appear to be in every respect well suited for the purpose of lymph propagation, are of a special breed, and are obtained from the Department of Corrèze in the southern half of France. They are all of a uniform reddish-brown colour, with fairly long, soft hair. Their skin, when exposed by shaving, is seen to be particularly smooth and supple, and it varies in colour from pink to a pale shade of brown. For the purpose of keeping free from urine the straw-bed which comes into contact with the surface of the body operated on, only cow-calves are employed, which vary in age from four to six months, the average being about 18 weeks. Prior to being brought to the Institute stable they are kept for about 12 days in a

quarantine shed in the outskirts of Montmartre. They are all weaned at the age of two months, and they receive no milk or eggs while at the quarantine shed or at the Institut stable, the food of each calf consisting of—

1 litre of crushed oats;
2 litres of bran; and
3 kilos of hay

twice daily, at about 6 a.m. and 4 p.m. At both places water is supplied from the town mains.

The calves cost, on an average, about 125 francs, with an additional 22 francs for travelling, &c., making 147 francs in all. After use, they are sold to a butcher, at a loss of from 30 to 40 francs.

On the day after arrival at the stable, the calves are vaccinated. Injection of tuberculin is not employed, as the directors consider this unnecessary, in view of the fact that immediately after collection of the lymph each calf is sent to the abattoir and slaughtered under the personal supervision of a medical man whose report is awaited before any of the lymph is distributed for use. In the event of any signs of tuberculosis being found, the whole of the lymph derived from this particular animal would be destroyed.

Vaccination of Calves.—For this purpose one or more large tubes of glycerinated lymph, which have been kept for at least a month subsequent to its collection and storage, are employed, the directors considering that better results are thus obtained than if the operation were carried out directly from calf to calf.

For the purposes of the operation the calf is strapped to a tilting table somewhat similar in design to those employed in this country, but the right hind leg of the animal is not elevated, and in consequence the mammary region is not exposed, indeed it is not utilised for inoculation. (*See* Plates I. and II.)

To prepare a surface for the insertion of the lymph the right side of the animal is thoroughly scrubbed with soap and hot water, and then shaved over an area extending between the internal edges of the fore and hind limbs and from some four or five inches below the spinal ridge to the umbilicus. The shaved area is next washed with soap and hot water, then with a hot solution of boracic acid, and, finally, with plain hot water. It is afterwards dried with clean soft cloths.

A number of superficial incisions, each about 1 inch long, are then made in a direction at right angles to the long axis of the body and about a couple of inches from one another. The incisions of the several rows are made *en échelon*. The lancet employed for the purpose has a spear-headed blade, this shape being specially recommended by M. Chambon. Over each incision a drop of glycerinated lymph is allowed to fall from a glass tube, and the drop is rubbed in with the flat portion of the blade of the lancet. The process is carried out by one of the laboratory servants, and is a somewhat lengthy one.

When the lymph has dried, the calf is removed from the table and taken back to its stall.

Collection of Lymph.—The vaccine material is always collected on the sixth day. The calf is once more placed on the table; or, if material is required for immediate use only, it is usually allowed to stand. (*See* Plate III.) The vaccinated area is washed with warm water and dried with clean soft cloths. Each vesicle is now clamped separately, and the crust first removed with a lancet, which is then wiped on a cloth pinned to the front of the clean cotton blouse which the operator has previously donned.

The vesicle is then thoroughly scraped with the edge of a somewhat blunt lancet, and the resulting mixture of lymph, epithelial tissue, and blood is transferred to a small nickel crucible set in a wide wooden stand on a table close to the operator. The crucible is provided with a cover which is kept over it except at the moment when a further addition is made to its contents. The collection of all the vesicular material obtainable from one calf appears to take about three-quarters of an hour.

To the pultaceous mass contained in the crucible there is added about an equal quantity of glycerine which was described to us as "doubly rectified," but which appeared to be of very thin consistence as compared with the best English glycerine. No accurate measurement of the quantity employed is made.

The mixture of pulp and glycerine is triturated in a mixing machine devised by Dr. Chalybäus, of Dresden; the particular one that we saw being driven by a small electric motor. (A description of this machine by Dr. Chalybäus himself will be found on page 9.)

The mixture, having thus been rendered thin and homogeneous, is received in a clean sterilised nickel crucible placed beneath the machine, but with a view of still further improving its appearance and of removing any extraneous matters, such as hairs, it is afterwards pressed through a small brass-wire sieve consisting of extremely fine gauze into an agate mortar. This is done by means of a bone spoon, and there is left on the surface of the gauze nothing but a very small quantity of epithelial tissue together with a few hairs. The mixture is further triturated in the mortar with an agate pestle, and is then ready for filling into the tubes in which it is distributed.

Storage of Lymph.—The lymph material is next drawn up into a sterilised glass syringe provided with a metal nozzle of such a size that the tubes to be filled can easilybe fitted over it. Slight pressure on the piston of the syringe causes sufficient lymph to enter the tube. Each tube is filled about two-thirds full, and is then placed on a porcelain tray, pending its being sealed. This is done without delay by means of a blow-pipe, the air blast of which is provided by means of a pressure apparatus in one corner of the room. The tube is first tilted until the column of lymph occupies the central portion, and it is then held in a horizontal position, while each end is successively placed in the blow-pipe flame, and, when sufficiently melted, drawn out by means of a pair of forceps, and so sealed.

Distribution of Lymph.—The tubes when sealed are placed with a small surrounding of cotton-wool in small light metal tubes provided with a tightly-fitting cover. These cases, if sent out singly, are fitted into a block of wood grooved on one side; being kept in position by a paper label, which is gummed round the block, and which has on one side space for postal address and stamp, and, on the other, directions for use.

A register is kept of persons to whom supplies of lymph are sent, and of the calf from which each supply is derived.

Académie de Médecine.

We also visited the vaccine station of the Académie de Médecine, of which Dr. Hervieux is the director. The general principles on which this institution is conducted are so similar to those which have been set out at length, in the description of MM. Chambon and Ménard's establishment, that it is unnecessary to enter into similar details again. It should be mentioned, however, that at the Académie de Médicine the calves employed were not of the same breed as those

used at the Institut Vaccinal, neither did the vesicles which we had an opportunity of seeing, on a single visit, appear to be quite equal in character to those which we observed at the latter institution.

Calf-to-Arm Vaccination at Nanterre.

While in Paris we were afforded an opportunity of seeing an extensive series of vaccinations and re-vaccinations, carried out directly from calf-to-arm, at the Nanterre House of Detention. The calf, which arrived at the establishment in a closed van, a photograph of which we append (*see* Plate IV.), was brought from the vaccine institute of MM. Chambon and Ménard, and the vaccinations were carried out by M. Chambon and by one of the medical officers to the establishment.

The operations were performed in a small square room having a door at each of two opposite angles; opposite the door of entry the calf was tied up to a post, and, in front of and facing it, an assistant took up his position in order to collect the lymph, by scraping slightly one of the vesicles on the calf's abdomen, to which compression forceps had been applied. On his right hand were placed a tray containing lancets and compression forceps, a rack for holding charged lancets, and a glass bowl containing a pad of cotton-wool floating in perchloride of mercury solution. On either side of him, and so arranged as to be able with ease to reach the tray, sat one of the two operators, each of whom had placed in front of him a chair for the vaccinee.

The male inmates, each with his shirt sleeve on the left arm rolled up to the shoulder, were admitted by the door opposite the calf, an assistant, wearing an ambulance badge, giving the upper part of each person's arm a brisk rubbing with a cloth soaked in boracic acid solution as he entered, the arm being afterwards dried with another cloth. Two or three warders were also in attendance, who so directed the stream of inmates that each operation chair was refilled as soon as vacated.

On an inmate seating himself, the operator took a charged lancet from the rack, with which he made three punctures in an oblique direction, just beneath the skin of the upper arm. The lancet was then dropped into the glass bowl containing the disinfectant, from which, in turn, it was removed by the assistant, who wiped it on a previously sterilised cloth, and the instrument was then recharged.

One assistant was thus able to keep the two operators supplied with charged lancets as rapidly as they were required, and it will be obvious that the whole scheme of operation had been well devised, and was skilfully and expeditiously carried out, when we mention that during our visit no less than 480 vaccinations were performed in the short space of 39 minutes. Most of the vaccinations were re-vaccinations, some of the inmates having been submitted to the same operation on the occasion of previous admissions to this or similar institutions.

Arrangements for Gratuitous Domiciliary Vaccination in the Town of Paris.

As already stated, MM. Chambon and Ménard are entrusted, by the municipality of Paris, with the carrying out of arrangements for the vaccination and re-vaccination of the inhabitants of the town; and on receiving information of the occurrence of small-pox in any part of the city, they make domiciliary visits for the purpose of offering vaccination to persons who may be unable or unwilling to attend the public stations.

DOMICILIARY VACCINATION IN PARIS.

(From " L'Illustration " of September 16, 1893.)

The notifications as to the existence of small-pox are at once sent on to MM. Chambon and Ménard, who then make arrangements to attend at the house or neighbourhood in question on the following day; but in the meantime the day and time of attendance are intimated to the inhabitants by means of printed cards having blank spaces for the insertion of the necessary particulars. In Paris each "house," in most of the quarters occupied by the poor and the working classes, is made up of a series of flats, which, again, are subdivided up into dwellings of one or more rooms, the number of persons inhabiting each house being, therefore, much greater than is the case in this country. Each such "house" has a porter's lodge at the entrance, and it is outside this lodge that the notice previously mentioned is displayed, and it is in this lodge also that, at the pre-arranged time, the vaccinations and re-vaccinations are generally performed. For these operations calf lymph is invariably employed, the process being carried out direct from calf-to-arm, a previously vaccinated calf being sent to the house from the Institut Vaccinal in a specially constructed van, of which an illustration is appended (*see* Plate IV.). Occasionally, from want of space in the porter's lodge or other reasons, the calf, after being removed from the van, is allowed to remain in the street, its halter being held by an attendant, while another assistant, taking his seat on a camp stool, proceeds to collect lymph from the inoculated area of the animal's side and abdomen, with the aid of clamp forceps and lancet. Where such procedure is considered necessary, the persons requiring vaccination, whether infants or adults, also are brought out into the street, and the extraordinary spectacle may be witnessed of vaccinations being carried out by the medical staff surrounded by an interested crowd of sightseers.

We append a copy of an engraving which recently appeared in the illustrated supplement to "Le Petit Parisien," in which M. Ménard and his staff are depicted carrying out "public" vaccination under the circumstances described. The drawing was made without the knowledge of M. Ménard, but is substantially correct in its details.

MM. Chambon and Ménard attach much importance to this organisation and practice. They say that, under the immediate influence of existing small-pox, large numbers are willingly submitted, both to primary and secondary vaccination, who would otherwise escape; and they are of opinion that certain classes who might object to be vaccinated with lymph from an unknown source, find all their objections on this score removed when they actually see the calf which serves as vaccinifer.

We were supplied both by Dr. Hervieux and by MM. Chambon and Ménard with samples of the glycerinated lymph, which had been collected and prepared on the occasion of our visits. That which was obtained from the Académie de Médecine was collected on December 10th, 1896. It was used by Dr. Cory at the Board's Animal Vaccine Station for the vaccination of 27 children on December 29th. All the cases were, as usually, vacinated by means of five insertions of lymph, and the insertion success obtained was 99·3 per cent.

That obtained from MM. Chambon and Ménard was collected on December 8th, 1896; it was used by Dr. Cory on December 22nd and 31st, and on January 7th, 1896, for the vaccination of 96 children, and every one of the five insertions succeeded in every child.

Brussels.

At Brussels the propagation, storage, and distribution of calf lymph is carried out at the École Vétérinaire, under the supervision of Professor Degive, the director of that establishment.

The building set apart for the calf-lymph station contains the director's room, a distributing room, an operating and preparation room, and two stables. As, however, we were informed by Professor Degive that the accommodation at present provided is regarded as very insufficient for the purpose, and that a new vaccinal institute is about to be erected, it would serve no useful purpose to enter into a detailed description of the present building.

Stable.—The stable, which is a detached building, contain stalls for six calves, three on either side of a central footway, and the stalls are so arranged that a space is also left between them and the side walls of the building. The stalls are very narrow, and, at the end furthest from the central passage, have two iron uprights fastened to the sides of the stall. Iron rings, which are attached to the animal's halter by means of steel clips, slide up and down the uprights. This arrangement permits the calf to stand up or lie down, but prevents all possibility of its licking the inoculated portion of its body.

The stable is warmed by an iron stove, the temperature at the time of our visit being 15° C. It is ventilated by windows opening inwards in the upper part of the two outside walls, and the removal of vitiated air is further facilitated by four outlet ventilators, each about 6 inches square, and placed just above the floor level, the up-draught being aided by means of gas jets in the outlet shafts.

Calves.—The calves are not of any special breed, and those that we saw did not seem to be so well suited for the purpose of lymph propagation as certain of those thus employed at the Institut Vaccinal in Paris. Another point of difference is that at Brussels male animals are used exclusively; Dr. Degive believing that the finest vesicles are obtained on the scrotum. For the first four days after their reception the calves are kept in a separate "quarantine" stable. On the day prior to vaccination they are swung, by means of a belly band and an arrangement of pulleys, into a wooden, zinc-lined, tank bath, capable of containing sufficient water to cover nearly the whole body. The temperature of the water is kept at about 30° C. In this bath the calves are scrubbed all over with soft soap. After removal from the bath, the skin is thoroughly dried with cloths, and the animal is then placed in the stable adjoining the operating room.

Each calf is injected with 1½ cubic centimetres of tuberculin on the day prior to vaccination, but Dr. Degive considers this an unnecessary precaution for the reasons that (*a*) tuberculosis is very rare in calves, and that (*b*) no lymph is distributed until the animal from which it was obtained has been slaughtered, and necropsy has made it certain that the animal was not the subject of tuberculosis. In the event of tubercle being found the lymph would be destroyed.

The *age* of the calves employed averages from 10 to 14 weeks, but animals four months old are sometimes used.

The *food* of the calves consists principally of milk and eggs, each calf receiving, in 24 hours, 12 litres of milk and four eggs, together with a little hay, which is placed in each stall for the animal to eat if it is so disposed.

Inoculation of Calves.—The calf is fixed, by means of ropes, to a tilting table of somewhat primitive construction, the right hind limb

being elevated, as is usually done in England. A leather blinker is also fastened over the head. The right side and the abdomen are washed with soap and water with which lysol is mixed, and the surface is then shaved. The skin is afterwards washed with warm boracic acid solution, then with hot boiled water, and it is subsequently dried with cloths which are sterilised by steam just previous to use. All instruments are also boiled in a solution of boracic acid. The lancets employed are similar in form to those devised by M. Chambon, while the compression forceps appeared to be of somewhat old design and needlessly heavy.

The operator and his assistants all wear white blouses, which, just previous to use, have been sterilised in an autoclave.

Incisions, about two or three inches in length, are made at right angles to the long axis of the body, all over the shaved area of the skin, and also on the scrotum; the average number for each calf being about 150. The incisions are made with a dry lancet, and are placed *en échelon*, and about a couple of inches distant from one another.

The lymph employed for vaccination is kept in stock for, at least, six weeks previous to its use; it consists of vesicular pulp which, at the time of collection, is simply mixed with twice its weight of glycerine and is then kept in a glass tube, the mouth of which is closed with a cork fixed with paraffin until required. Just before it is needed for inoculation of a calf the pulp is ground up in a small agate mortar with a further small quantity of glycerine. The resulting emulsion is well rubbed into each separate incision on the skin by means of a thin ivory instrument resembling a small paper-knife; the edge being passed up and down each incision several times.

Collection of Lymph.—On the sixth day the calf is again fixed on the operating table, and the vaccinated area is once more washed with warm water and dried with sterilised cloths. The lymph required for stock purposes is then first collected. For this purpose compression forceps are applied to each vesicle separately, and the crust is first carefully removed with the edge of a lancet. These crusts are collected in a watch-glass, and are employed for the vaccination of children. The vesicular pulp is next removed by scraping with the lancet, and the material is collected in another watch-glass or Petri dish and weighed. Glycerine is added to it from a stock bottle to the extent of about twice the weight of the pulp, but the amount is only roughly estimated, no actual measurement or weighing being deemed necessary. The pulp and glycerine are stirred together, and are at once placed in a glass tube of such a size as to ensure its being almost entirely filled with the material available; it is then fastened down by means of a glass stopper or cork, without further manipulation.

When sufficient pulp for stock purposes has been obtained, the remainder of the vesicles are scraped off with a Volkmann's spoon, and the material is mixed, as before, with glycerine, without trituration.

The glycerine employed was stated to be of English manufacture, but was much thinner than that usually sold in this country, giving the impression, indeed, that it had been considerably diluted with water. It is sold as being "chemically pure."

Storage and Distribution.—Just as is the case with what is termed the "stock" supply, this material is ground down in a mortar, with more glycerine, before being distributed for use.

According to the amount required, the emulsion is either stored in tiny stoppered bottles, which are supposed to contain enough material for 25, 50, or 100 vaccinations; or, when a less quantity is desired, the material is placed in a slight excavation on the surface of a small glass

plate about 1 inch square, and a plate of a similar size, but not hollowed out, is slid over it. The edges are sealed with paraffin, and the whole is wrapped round, first with tin foil, and then with paper.

The small bottles are fitted into blocks of wood, bored with holes for the purpose, in order that the parcel may go safely through the post.

To each package is attached, by string, a doubled card, which can be addressed outside, and which, inside, has spaces for particulars as to number of vaccinations carried out, the number of insertions in each case, and the amount of success which results.

The lymph which was supplied to us by Professor Degive was used for certain bacteriological investigations; hence we have no record as to its success when used for the purposes of vaccination. But, from a number of returns made by different vaccinators to Professor Degive, we found that these showed a high per-centage of insertion-success.

While at Brussels, we also visited the Municipal Vaccination Station, of which Dr. Janssens, the Medical Officer of Health, is director.

We were informed that the station, which consists of a waiting and an operating room, is open daily, but that, practically, no children are brought for vaccination during the winter months. This was unfortunately the case at the time of our visit, so that we had no opportunity of seeing the work in actual operation.

The lymph employed is received in small glass-stoppered bottles from Professor Degive, of the École Vétérinaire.

Berlin.

The Animal Vaccine Establishment at Berlin, of which Dr. Schultz is the director, is situated in the Central Meat Market, on the outskirts of the city.

The station consists of three parts connected with one another: (1) A large stable containing stalls for the calves; (2) a work-room fitted with two tilting tables, somewhat similar to those in use in England, on which the calves are vaccinated, or the "lymph" collected; and (3) the director's room, in which the lymph is triturated, glycerinated, and stored. This room contains cupboards and benches, and is fitted with all the necessary bacteriological apparatus, glassware, and instruments; the latter being made entirely of metal, so as to admit of their being readily sterilised.

Calves.—Cow-calves are almost invariably used, as less likely, when they lie down, to foul with their urine the vaccinated area of the abdomen than are males. The calves employed are usually from about six weeks to three months old. They are received 48 hours before they are required for vaccination, and are at once injected with half a gramme of tuberculin. If their temperature should rise above 41° C. during the next 24 hours they are not employed for the production of lymph. The calves are fed on a mixture of milk, eggs, and corn flour, of which the milk is always sterilised prior to use.

Vaccination of Calves.—When placed on the table, the abdomen is shaved from the vulva to the umbilicus, and a portion of the inside of each thigh is also shaved. The surface of skin thus exposed is carefully scrubbed with soap and water, washed with a solution of corrosive sublimate 1-1000th, and then again washed with boiled water. The operator also washes his hands carefully, using carbolic

soap, and before commencing to operate puts on a white cotton blouse over his coat. The calf's skin having been dried with a clean towel, long parallel incisions are then made over the whole length of the abdomen, and also over the shaved portion of the thighs. These incisions, which are made with a blunt knife, so as to draw as little blood as possible, are hardly a quarter of an inch apart, and are about 18 to 24 inches in length on the surface of the abdomen. If any blood appears along the line of the incisions it is removed by means of sterilised blotting paper. A few grammes of stored glycerinated lymph, prepared some weeks or months previously, are next poured on the abdomen and spread over the incised lines with the back of a scalpel.

Collection of Lymph.—On the fifth day (120 hours after vaccination) the calf is again placed on the table. After a thorough cleansing of the skin in the same manner as before, absolute alcohol is poured over the vaccinated area. When the alcohol has evaporated the surface is treated with ether, which is supposed to exert a bactericidal, in addition to its anæsthetic action. Then the skin is put on the stretch and scraped, in the direction of the incisions, with a sharp spoon. The spoon is taken over each portion of the vaccinated surface *once* only, so as to avoid, as far as possible, admixture of blood; and by this means all the epithelium which has undergone vesicular changes caused by the action of the specific virus is removed in long strips of about one-eighth inch wide. Compression forceps are not needed, and the whole operation is completed in a few minutes.

Preparation of Lymph.—The whole mass of epithelial tissue removed by the spoon is collected and emptied into a glass Petri dish, and afterwards it is weighed in a delicate balance. Seven times the weight of cold boiled water and a similar quantity of glycerine are then weighed out separately. A small portion of the water is added to the dish containing the tissue scrapings, and after being stirred together the mixture is passed between the small porcelain or glass rollers of a mixing mill, invented by Dr. Döering. In this mill the epithelium is gradually broken up, and as this is being accomplished, the remainder of the water is gradually added; the entire bulk of the mixture being subsequently passed through the mill a second time.

Formerly it was the custom at this station to add both glycerine and water to the epithelium partly before and partly during its passage through the mill.

For some months past, however, it has been the practice not to add the glycerine until *after* the material has been twice passed through the mill. This grinding process is effected with more difficulty in the absence of glycerine; but the reason for the alteration is that much of the lymph is now centrifugalised, a method of procedure which would be unduly prolonged if the specific gravity of the emulsion operated on had previously been increased by the addition of glycerine. The centrifuge at present in use is a small two-armed instrument worked by hand; its use involving the employment of an extra assistant for at least a couple of hours. At the end of this time the minute shreds of epithelium contained in the mixture have settled into a compact mass at the bottom of the tube, and the supernatant fluid is only very slightly opalescent. This is decanted off, and an amount of glycerine equal in weight to that of the water previously employed is intimately mixed with it, after which the resulting "lymph" is stored in a stock bottle fitted with an india-rubber stopper and cap; or it is put up in small glass tubes of 1 cc. capacity, each of which contains, according to Dr. Schultz, sufficient material for 100 vaccinations. The amount of vesicle pulp

collected from a single calf varies from 10 to 15 grammes. This, when intimately mixed with the usual amount of dilute glycerine, is calculated to provide sufficient material for the vaccination of, at least, 15,000 persons.

This process of centrifugalisation is as yet only tentative and experimental. The appearance of the "lymph" is thought to be improved by its adoption, and, when tested by the method of plate cultivation, it is found to be freer from "extraneous" microbes than is an equivalent amount of the emulsion when tested before treatment in the centrifuge. Objection, however, to the employment of the method might be based on this freedom if, as there is every reason for believing, the microbe specific to vaccine is present in a far greater amount within the cells of the vaccinated dermis than in the intercellular lymph spaces. Even if free in the fluid portion of the mixture, and of exceptionally minute size, the continued action of the centrifuge must tend in time to remove them, just as is found to be the case with other microbes which may be present.

The amount of glycerine and water employed in the preparation of vaccine material has been considerably increased during the past twelve months, the relative proportions being at present:—

Epithelial pulp	1 part.
Glycerine	7 parts.
Boiled water	7 „

All "lymph" is now tested bacteriologically by means of plate cultivations, before being distributed. This is done in consequence of the recommendation of a scientific committee of which Professor Koch was a member and which has recently been sitting at Berlin to inquire into the whole subject of the collection, purification, and preservation of vaccine lymph.

Season of Calf Inoculations.—Inoculations are only carried out in the months of May, June, and July. The calves being themselves vaccinated with stored glycerinated lymph, it is not necessary to keep going a continuous series; and in these three months sufficient lymph is manufactured for use during the whole year throughout one of the largest of the eight districts into which the kingdom of Prussia is divided for vaccination purposes.

Disposal of Calves.—After collection of lymph, the calves are sold to the Jewish Rabbi to be slaughtered for food. We were informed that a *larger price* is given for them than is ordinarily the case with calves brought to the Central Meat Market, owing to the fact that they are in such fine condition as the result of good feeding while at the station.

Glycerinated calf-lymph collected and prepared as above stated on the occasion of our visit on January 10th, 1897, was used by Dr. Cory for the vaccination (*a*) of 30 children on January 19th, with an insertion success of 97·1 per cent.; (*b*) of six children on January 21st, with an insertion success of 86·6 per cent.; (*c*) of 40 children on February 25th with an insertion success of 92·3 per cent.; and of 33 children on March 4th with an insertion success of 67·5 per cent. This sample of glycerinated lymph was again used after having been kept until six months had elapsed since the date of its preparation. It was then found that its activity on vaccine lymph had practically disappeared. It is right to state in this connexion that at the Board's Animal Vaccine Station there are, as yet, no means of storing lymph elsewhere than in the somewhat high temperature at which the operating rooms are maintained.

Dresden.

The Animal Vaccine Institute, of which Dr. Chalybäus is director, is situated in the northern suburbs of Dresden. It consists of a small two-storied building, containing, on the ground floor, an operating room and three other rooms, while the whole of the first floor is utilised as a dwelling for the caretaker. Adjoining this building is a small stable containing stalls for the calves.

Dr. Chalybäus informed us, however, that the Animal Vaccine Institute was hardly arranged in accordance with modern requirements, having been established more than 12 years ago, when the present methods of preparing lymph were not in vogue.

The stable in which calves are placed on arrival contains two stalls and a tank bath in which the animals are thoroughly washed before use. The calves are lifted into and out of this tank by means of belly-bands attached to a system of pulleys fixed to the ceiling. After having been dried with cloths they are vaccinated and then placed in another stable on the opposite side of the house.

The calves are bedded in their stalls on fine wood shavings, which are said to have the advantage of being clean, dry, and comfortable.

The operating room is about 20 feet square, and contains two tables. One of these is for calves; the other, of larger size, and fitted with mechanical arrangements for tilting and raising, is for young bullocks, which are occasionally employed for purposes of vaccination, when either an extra amount of lymph is required or when it has been impossible to obtain the required number of calves.

By preference, Dr. Chalybäus employs cow-calves of from six to eight weeks old.

The calf table is an oblong, shallow trough of wood, provided with straps and with *two* iron uprights at one end, to which the hind limbs of the calf are fixed in a V-shape. This method of fixation, however, enables the animal to struggle to such an extent as to raise its hind-quarters completely off the table. After having been shaved, and before vaccination, the animal's skin is washed with soap and hot water containing lysol. The soap suds having been washed off with more water, and the skin dried with a cloth, benzine is poured over the surface to render it more aseptic, and is rubbed in with sterile sponges of gauze, which are kept for use in a sterilised glass-stoppered bottle. Lengthy incisions are next made with a blunt scalpel, in the long axis of the body, over the inside of the thighs and over the whole surface of the abdomen from the vulva to the umbilicus; also over the lower ribs. Glycerinated lymph *which has been stored in sealed tubes for about three months* is next rubbed in over the area of the incisions with the flat surface of a small trowel-shaped instrument.

We were informed that much difficulty is experienced in this establishment in obtaining calves suitable for purposes of vaccination, as throughout Saxony it is the custom to slaughter these animals for good at a very early age, sometimes within a few days of birth. This being so, calves have to be imported from a distance, most of those employed by Dr. Chalybäus coming from Berlin or Hamburg. They are obtained by a local cattle-dealer, who charges 20 marks for their use, and who removes them for slaughter immediately after collection of the lymph.

Calf-to-arm vaccination is never employed in Saxony as it is thought to be undesirable to use lymph from an animal until a necropsy has shown it to have been entirely free from disease.

Collection of Lymph.—The lymph, or rather the vesicle pulp, is collected after an interval of four complete periods of 24 hours. The skin is first washed with white soft soap and hot water, the operation being carried out with the aid of a large house-painter's brush. Such crusts as have formed are removed as far as possible with the edge of an ordinary metal tea-spoon, after which glycerine is poured over the skin and rubbed in with gauze sponges.

The pulp is collected by scraping with a Volkmann's spoon, but as Dr. Chalybäus goes over the same surface again and again, a not inconsiderable amount of blood becomes mixed with the epithelial scrapings. The raw surface of the abdomen is afterwards dusted over with fine oatmeal.

The pulp thus collected is weighed and is then run through a mixing machine invented by Dr. Chalybäus, of which a special description, written by him, together with an illustration, is appended to this report. The necessary motive power is supplied from a small water motor fixed beneath the floor of the room.

After being ground up in the machine, four times the amount of a mixture of glycerine and sterilised water (water 3 parts, glycerine 1 part) added to the vesicle pulp, and the whole is then run through once again to ensure thorough admixture. The resulting emulsion is received into a porcelain mortar placed beneath the machine. The mortar is removed when all the material has passed through, and its contents are then taken up by suction into tubes of somewhat large calibre which, when filled, are closed at either end by means of sealing wax.

Dr. Chalybäus considers that one gramme of glycerinated emulsion is sufficient for 80 vaccinations. The vesicle pulp obtained from a single calf affords from 50 to 75 grammes of the glycerinated emulsion; or, in other words, enough for the vaccination of from 4,000 to 6,000 persons.

Glycerinated calf-lymph collected and prepared by Dr. Chalybäus on the occasion of our visit on January 12th, 1897, was used by Dr. Cory for the vaccination of 15 children on January 21st. The children were, as usually, vaccinated by means of five insertions, and every insertion gave a successful result.

(*Translation.*)

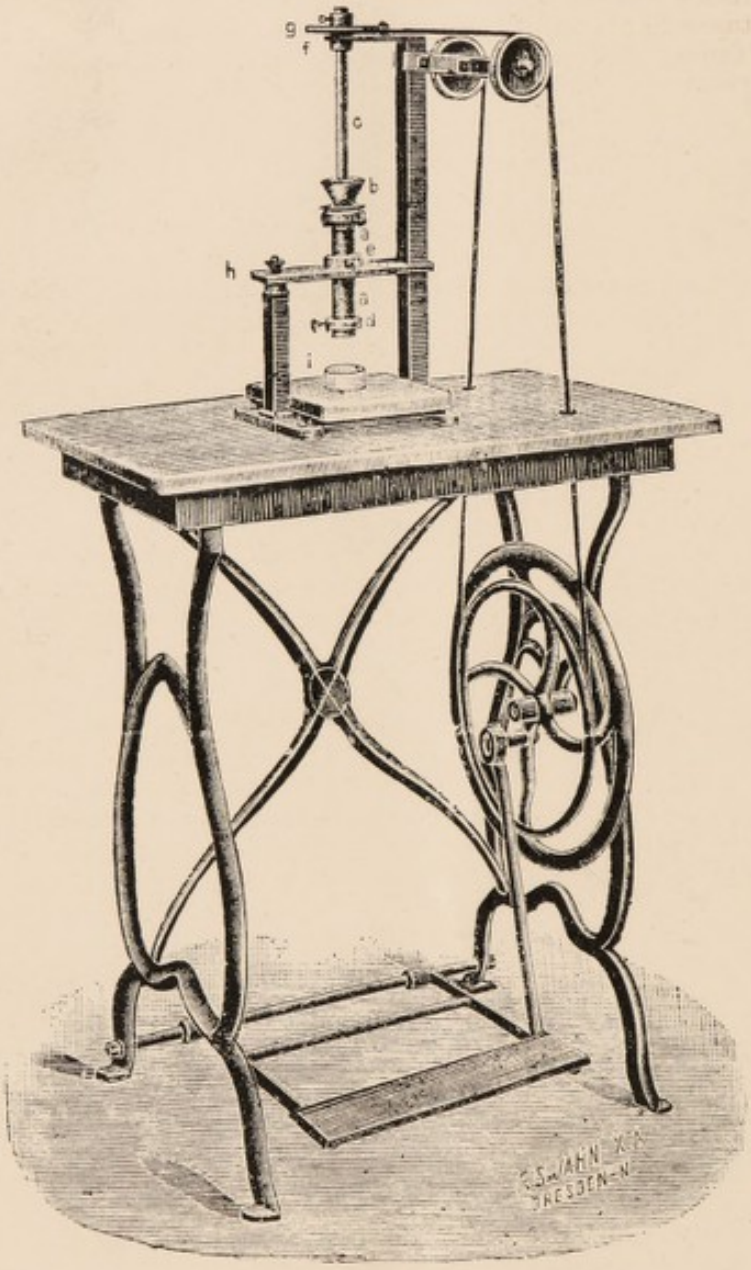
REPORT OF THE ROYAL INSTITUTE FOR VACCINATION IN DRESDEN.

About the Technique of Preparing Animal Lymph, by Dr. Chalybäus, Dresden.

As a rule the exclusive use of animal lymph for vaccination has been everywhere adopted, whilst the use of human lymph, taken from children, has been almost entirely abandoned, and public Institutes for vaccination prepare only calf lymph. The preparation of animal lymph needs special contrivances, because the lymph scraped out of the "small-pox of a calf," in order to make it available, must be triturated and ground to a fine pulp, and with the addition of glycerine, turned into a thin and homogeneous emulsion. When triturated in a dish or bowl this operation takes, for the quantity of lymph obtainable from one calf, three hours time, and cannot therefore be done by the physician himself; nevertheless, great care must be taken, as it is unwise to leave that part of the preparation of lymph to a common workman, who cannot be properly and continuously watched.

As far back as 1889 I constructed a machine for triturating lymph, which stood the test of use in the Institute of this country and of those of many others. In 1893 the machine was improved. It is now fitted upon the marble table of a sewing engine, and moved either by foot or, still better, by means of a small hydraulic, steam, or electric motor.

A cylinder formed out of two equal parts, having in its inside threads of a screw, is attached to the shank of a column; a close fitting spindle,



LYMPH-MIXING MACHINE OF DR. CHALYBÄUS, DRESDEN.

likewise provided with threads of a screw, turns in the cylinder. Through a funnel the raw lymph is put into the upper end of the cylinder; in turning the spindle the lymph is rubbed and ground to the utmost, and leaves the cylinder on the lower opening, dropping into a glass dish.

By means of this contrivance the preparation is completed in about 15 minutes, although the work is done in a far better way than as usually in a dish. The lymph, consisting of coherent and liquid parts, is thoroughly rubbed, not only squeezed and turned into homogeneous emulsion. It does not lose its natural colour, nor does it get warm.

The apparatus is made of steel bronze, and its parts, comprising cylinder, spindle, and funnel, can easily be separated and disinfected in boiling water or otherwise.

The trituration occurring whilst the apparatus is closed—the opening of the funnel is closed by a cover of glass—no dust can enter, and should a calf hair accidentally have dropped into the lymph it can be removed whilst the lymph slowly drops out of the cylinder. No loss of lymph can occur, because the machine retains none of the material with which it is fed.

The machine can be obtained through the Royal Institute for Vaccination, in Dresden, price, 200 marks. Every machine is tested by the president of the above-mentioned institute, and a certificate is granted to each one sent out, as a proof of its fitness.

Directions for using the Machine for triturating Lymph, invented by Dr. Chalybäus.

1. *To take the machine to pieces*, slack the screw in claw *f* on which the driving-wheel *g* and spindle *c* is attached. Open the claws and remove the spindle and driving wheel *g* taking care not to let the former drop. Take off funnel *b*, slack screw of lower clamp *d*, and unscrew the middle clamp *e*, holding the cylinder in the left hand. Take the cylinder out of the support *h*. In order to separate the two parts of cylinder, use a small piece of wood by inserting it in the hollow, but care must be taken not to drop the parts when separated. Remove the driving-wheel from the spindle, and clean it, as well as the spindle and funnel, with a brush, and sterilise in boiling water.

2. *To put the machine together*, first join both parts of the cylinder, put on the lower clamp and turn its screw a little, pass the cylinder vertically through the support and place the funnel on the top of the cylinder. Then screw the driving-wheel on the upper part of the cylinder, open the claws and insert the spindle so far that the claws grasp the spindle close under the driving-wheel, shut the claws and screw tight. Bring the lower ends of spindle and cylinder exactly in a line and fasten the lower clamping screw. Finally, adjust the belt on the driving-wheel.

3. *To put the machine in motion*, move the fly-wheel *k* outwards, and to avoid friction use vaseline for lubricating the moving parts. It is advantageous first to run some glycerine through the cylinder, after which the lymph is placed in the funnel and the cover adjusted. If preferred, however, glycerine can be added to the lymph, and the mixture passed through the machine. The finished lymph leaves the lower end of the cylinder and drops into a small glass vessel *i*.

Cologne.

The buildings provided for this Institution are the most recent of their kind in Germany, and, as we were informed previous to our visit, all the fittings are of the most modern description.

We visited the Institution with Dr. Vanselow, where we were also met by the assistant director, the veterinary surgeon attached to the staff, and certain other gentlemen.

Dr. Vanselow presented us with a reprint of a paper written by him, showing a description of the buildings, illustrated with blocks giving the elevation and ground plans. We append a translation of this, so that it is unnecessary here to enter into any details as to structure.

Stable.—The calf stable, which adjoins the collecting room, contains 10 stalls, one of which is reserved for any calf used for experimenta purposes, while another is merely a pen forming the platform of a weighing machine. The sides and ends of the stalls are formed solely of a series of iron bars, painted grey, and they are of such narrow width as to make it impossible for a calf to turn round, it being thus prevented from licking the inoculated area of its abdomen. Each stall is provided with a gate at either end, opening outwards, and bears a numbered label of iron. The flooring of the whole stable is formed of cement concrete, over which in each stall is placed a wooden rack or platform which is raised about three inches from the floor. These racks are formed of wooden splines about two inches square, placed close together, the upper edges of each spline being slightly rounded. On these racks the calves stand or recline, no bedding of hay or straw being employed.

Calves.—The calves range usually from about six to eight weeks old. They are purchased in the meat market which immediately adjoins the estabilshment. The calves required for the current week are bought on Monday, and they are sold on the following Saturday, after their slaughter and the collection of lymph on the previous day; so that the stable is always empty from Saturday to the following Monday. The calves are kept under observation in the stable for 24 hours after their reception, and are vaccinated on Tuesday. Only three complete days are allowed for the progress of the local results of vaccination. On Friday the animal is slaughtered in a small slaughter-house opening off from the stable, and immediately it is dead the carcase is brought into the collecting room on a trolley (*see* Plate V.), the abdomen washed, and the epithelial pulp of the vaccination area is removed by means of a sharp spoon.

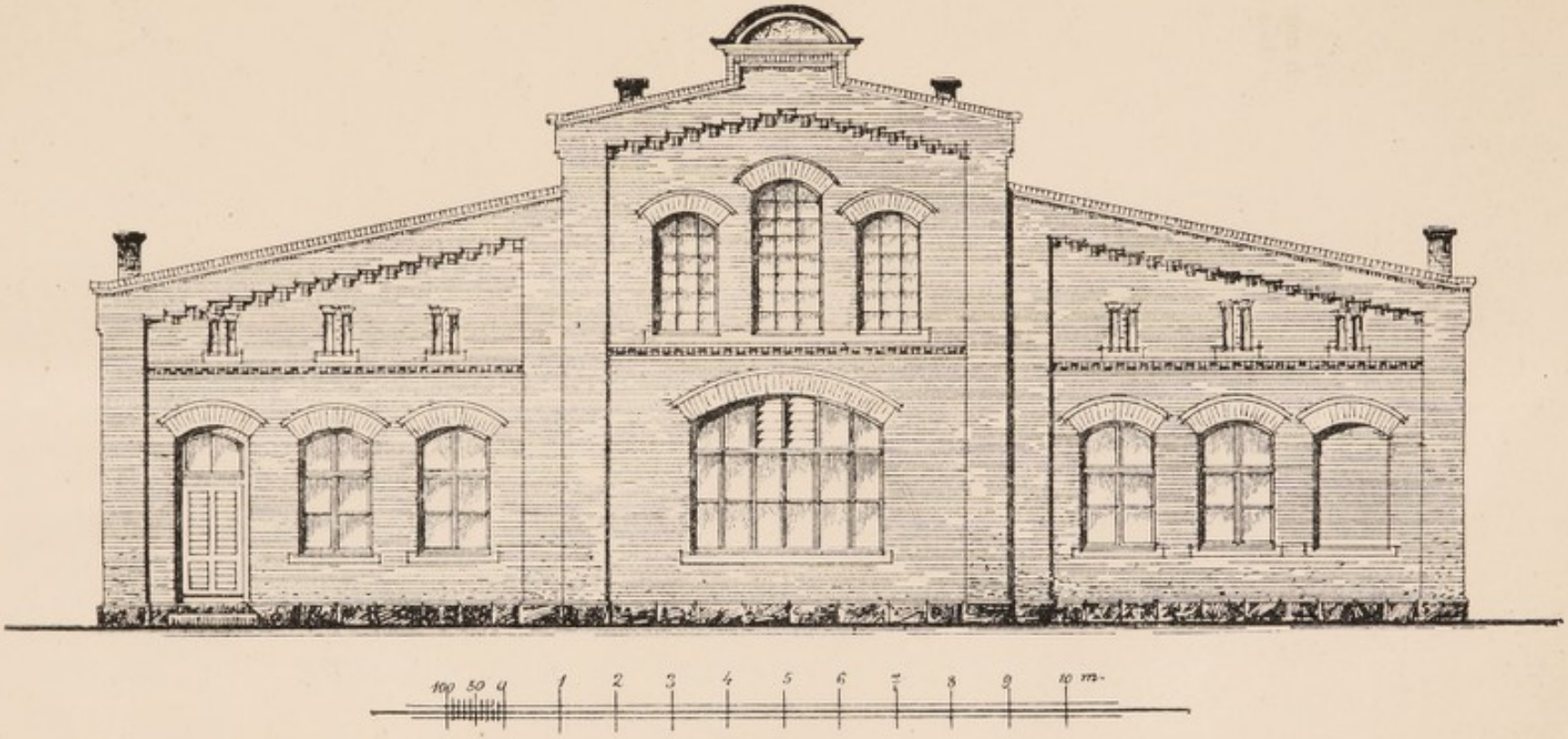
Vaccination of Calves.—We did not see the process of vaccinating the calves, but we learnt that it was carried out in an exactly similar fashion to that employed at the Berlin and Dresden stations, namely, by long parallel incisions over which glycerinated lymph is rubbed by means of a spatula or other flat-bladed instrument. The lymph employed for the vaccination of calves is always kept for a period of at least six weeks after glycerination, in order to ensure that it shall be as free as possible from extraneous organisms before it is used to vaccinate the calves.

After collection of the lymph pulp, and while it is being prepared for use, the carcase of the calf is taken back to the slaughtering room, where it it skinned and opened. The internal organs are removed and brought in on trays to be examined by the veterinary surgeon. In the event of his forming the opinion that any of the organs presented any condition indicative of disease, the lymph derived from the animal in question would be at once destroyed.

In view of this precautionary measure it is not deemed necessary to test the calves by the injection of tuberculin prior to their vaccination.

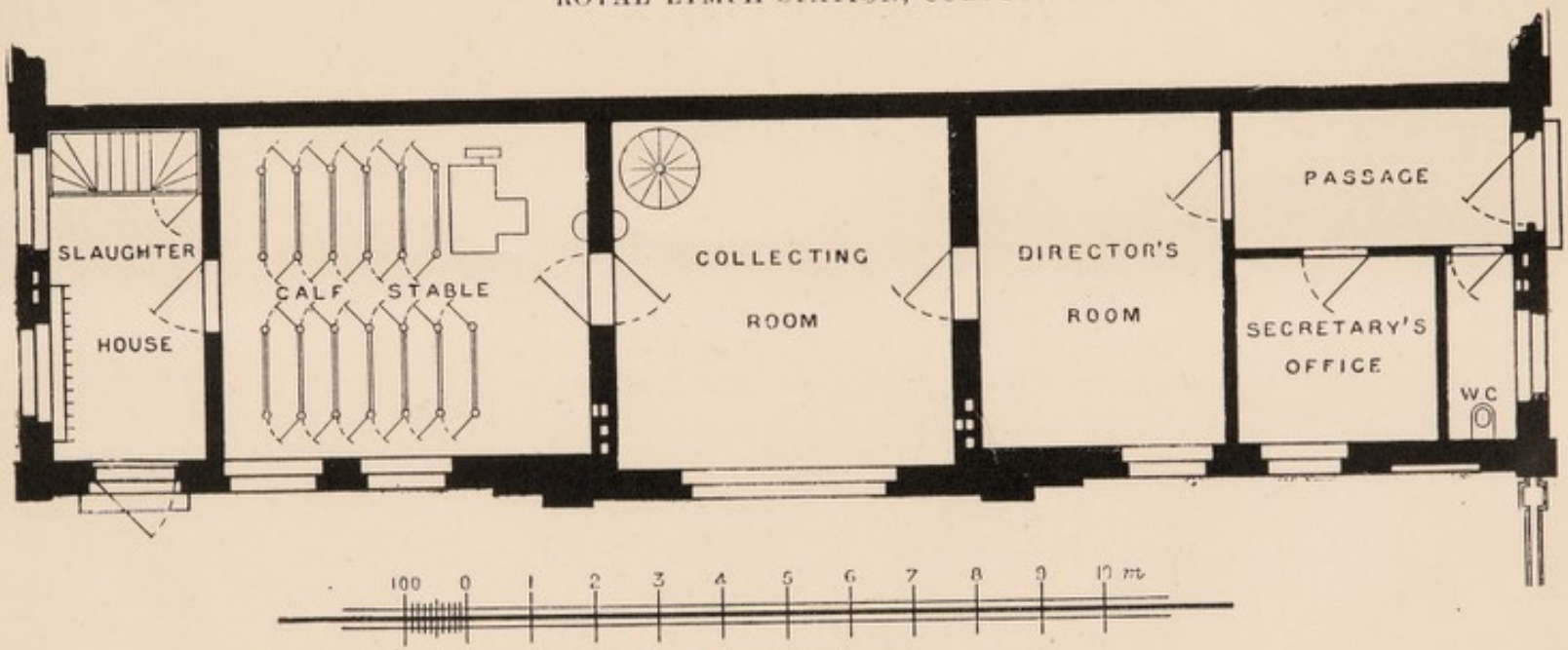
Collection and Preparation of Lymph.—The greatest amount of vaccine is collected during the months of March, April, and May, when from six to eight calves are employed every week. For the remainder of the year the weekly vaccination of one or two calves is found to be sufficient to supply all the lymph required for human vaccinations and revaccinations in the Cologne district.

ROYAL LYMPH STATION, COLOGNE.



Elevation.

ROYAL LYMPH STATION, COLOGNE.



Ground Plan.

In the preparation of the lymph material the epithelial pulp from the vaccinated area is removed by scraping with a Volkmann's spoon, and is received in a small glass dish. In this it is weighed, after which it is turned out into a mortar and thoroughly triturated; at first without any addition of water or glycerine; later, small quantities of water are gradually added to the extent of *five* times the weight of pulp. The mixture having been ground up still further, double the quantity of glycerine is finally incorporated. Thus, at the time of our visit, five grammes of pulp having been collected from one calf, the composition of the finished emulsion was as follows:—

Pulp - - -	5 grammes.
Water - - -	25 ,,
Glycerine - - -	50 ,,

Dr. Vanselow informed us that this quantity would suffice for the vaccination of 5,000 children.

The emulsion is afterwards forced into small bottles and tubes by means of a machine actuated by water power. This machine, which is manufactured by a Vienna firm, appears to be decidedly useful and convenient, and is capable of being worked in connexion with any form of pressure apparatus.

The small bottles are of different sizes, and contain lymph sufficient for 50, for 100, or for 150 vaccinations respectively. Both the bottles and their corks are sterilised prior to use.

We were struck with the numerous precautions which are taken in this institution to ensure thorough asepsis throughout the various stages of lympth production. Thus, in the collecting room, the flooring is of cement concrete, the walls are lined internally for about half their height with opaque glass tiles, the upper half being of parian cement. The shelves are of glass supported on iron brackets, and the surface of all tables consists of thick slabs of glass over green cloth, the glass being removable if necessary. The Institution is furnished throughout with electric light, and sterilised hot water is supplied as needed from a small apparatus affixed to the wall of the collecting room. India-rubber pipes used in connexion with the hot-water apparatus and the pressure apparatus employed for filling tubes are kept in a strong solution of carbolic acid when they are not in use. The director and all his assistants wear linen covers over their clothes; but only the sleeves, which are detachable, appear to be sterilised prior to each occasion on which they are used.

On the first floor of the building is a bacteriological laboratory, which is reached from the collecting room by an iron spiral staircase. It is fitted up with an autoclave, incubators, &c. But owing to the director being engaged in private practice, he has no time to work in this laboratory, which is, therefore, only used when it is desired to sterilise cloths, instruments, or glass-ware.

With the lymph and pulp material collected and glycerinated in our presence on January 16th, 1897, Dr. Cory vaccinated 34 children on January 19th with an insertion success of 98·8 per cent., and 21 children on February 11th with an insertion success of 93·3 per cent.

(*Translation.*)

THE ROYAL LYMPH STATION FOR THE RHINE PROVINCE AT THE NEW CITY CATTLE AND SLAUGHTERING ESTABLISHMENT, COLOGNE; BY SANITARY COUNCILLOR, DR. VANSELOW, DIRECTOR.

The public Institution for the preparation of animal lymph to meet the needs of the Rhine Province and the Hohenzollern districts was

erected in Cologne in 1889. The rooms at the old slaughtering establishment which were used until 1895 were extremely defective, being narrow, damp, and dark, and rendered any practically uniform arrangement impossible. In building the new cattle and slaughtering establishment the provision of a suitable annexe for the production of lymph was borne in mind from the very first; and so the present institution originated, which meets all the demands of hygiene and may justly be regarded as the prototype of such institutions.

The annexe is situate at one end of a large cattle shed, both having a common partition. The main front faces the north, so that all the rooms, as there are windows only in the front, receive their light equally distributed from that direction. The building is very solidly built, but under-cellared only, and to the smallest extent, on the eastern side. As, however, the whole of the ground was filled in, and only absolutely dry and permeable material employed, there is no fear of any dampness of the rooms.

On the ground floor of the building are the corridor, collecting room, calf stable, slaughter room, doctor's room, office, and a closet.

On the first floor, which is reached from the collecting room by a convenient winding staircase, is the laboratory, adjoining which, on both sides, is a large garret. The entrance to the building is from the street, and so arranged that the cattle establishment has not to be traversed in order to enter; the wall belonging to the entrance being continuous with the wall which encloses the cattle establishment. The calves are driven into the station through the doorway of the slaughtering room, which lies at the opposite end of the building.

While the floors of the slaughtering room, calf stable, collecting room, and laboratory are of concrete, the doctor's room and the office have inlaid wooden floors (parquetry); the corridor and closet are laid with "Mettlacher" tiles; and, finally, the rooms in the roof (garrets at the sides of the laboratory) are laid with floor boards. In the slaughtering room, calf stable, and collecting room the floor is slightly sloped in one direction, and at the lowest point there is a drainage outlet which is shut off by a small intercepting trap. The height of the rooms on the ground floor is 3½ metres, except the collecting room, however, which is 4½ metres in height, and that of the laboratory is 3½ metres. All the rooms on the ground floor are vaulted with plain solid arches. The laboratory and garrets have rafters and wooden ceilings. The collecting room, calf stable, and closet are lined, to the height of 1½ metres from the floor, on all four sides, with white opaque glass tiles; the slaughtering room, on three sides (the door side is excluded), to the same height with white glazed tiles. The remaining part of the walls in these rooms is painted with white porcelain enamel. The walls in the doctor's room and the office are papered. In the laboratory and corridor the walls are painted with oil paint. The collecting room is brightly lighted by a window 4 metres wide by 3 metres high. The light entering becomes strongly reflected by the brilliant white walls. The laboratory has three windows, the calf stable two, and the doctor's room and office one large window each. The closet and slaughtering room have each one small window. All the rooms are, therefore, amply lighted.

The calf stable contains 11 stalls for the reception of the calves, *i.e.*, six on one side and five on the other side of the centre passage. The stalls are so constructed that the wall nowhere forms the boundary of a stall, and a clear passage is thus given all round the stalls; they are each 70 centimetres wide and 150 centimetres long. The inclosures are formed of iron lattice work; at the two narrow sides of each there is a

door permitting the calves to be taken in or out by either side according to convenience. The iron lattice work is painted a light grey colour, so that every speck of dirt can at once be seen and removed. On the floor of the stalls lie wooden gratings. Upon the space which would correspond to the twelfth stall a weigh-bridge is sunk, inclosed with the above-described iron work; this machine allows of the calf being weighed while being taken through. The hollow in which the weigh-bridge stands has also a smell-preventing arrangement. The ventilation of the stable is obtained by a large tube which passes through the garret above. The collecting room has a flap ventilator in the window, as shown on the plan. Between the calf stable and collecting room there is an arrangement of double doors, one of which is thickly padded. The doors, padding, and through-air draught isolate the collecting room both from smell and noise. The closet is a so-called "Unitas" closet. Water is supplied by the city main, and in every room a sink is provided. The lighting is by electricity; in the laboratory, however, the "Auèrches Glühlicht" (a form of incandescent light) has been found preferable.

The heating is effected by means of American stoves; for the doctor's room, however, a gas stove has been provided by reason of its greater suitability. Large gas stoves serve for the heating of the water and milk. For the storage of considerable quantities of lymph a sufficiently large room is reserved in the refrigerating house of the city cattle establishment.

The furniture provided for the Institution is worthy of the handsome rooms and consists throughout of oak. The laboratory is completely fitted for bacteriological investigations, containing all sterilisation apparatus—thermostats, an excellent microtome, microscopes, centrifuge, &c.

The extent of the lymph production may be understood from the following figures:—In the year 1894 about 356,000 portions of lymph were issued, and in this year (1895) the number of portions will nearly reach 400,000.

Geneva.

The Institut Vaccinal Suisse, which was visited by one of us (Dr. Copeman) only, is situated at Lancy, on the outskirts of Geneva. It was founded in 1882 by M. Charles Haccius, the present director of the establishment. Originally a private venture, it is now recognised by the various cantonal governments, M. Haccius, in consideration of an annual subvention, supplying to public vaccinators throughout Switzerland, free of cost, all the lymph required by them in the performance of their duties.

The building in which the Vaccine Institute is housed adjoins a model dairy, also established and carried on by M. Haccius. The Institute building contains two stables for calves, an operating and collecting room, a laboratory, a room in which the packing and distribution of the lymph is carried out, and the director's room.

Stables.—Each of these contains four stalls. The side walls of the reception stable are of concrete; those of the stable adjoining the operating room are of wood. The floors of both stables are of concrete. Calves are received into the first-mentioned stable, and are there kept under observation for four or five days, at the end of which period they are passed into the stable next the operating room. The bedding of the stalls consists of fine wood shavings, this material being, in the opinion

of M. Haccius, decidedly preferable to straw as regards both the cleanliness and comfort of the calves.

Calves.—These range usually from about six to eight weeks old. They are fed on milk, obtained direct from cows in the adjoining dairy, in addition to which they are allowed a certain number of eggs. The calves are purchased from peasants in the surrounding districts. After vaccination and collection of the lymph, they are sold to a butcher in Geneva, at a loss of about 1*l.* on each calf. They are slaughtered in the public abattoir, and the veterinary inspector attached to that establishment furnishes a certificate relating to the healthiness of the calf and the condition of the viscera as ascertained on examination of the carcase.

Vaccination of Calves.—For the purpose of vaccination the calf is strapped down to a tilting table, similar in its main features to those employed in England. The head of the animal is covered with a leathern mask. The whole of the abdomen, the inside of the thighs, and a considerable area of the right side of the body of the animal is shaved, white soft soap and hot water being used in the process. The skin is next washed with a 1 per cent. solution of lysol, and finally with hot boiled water. It is dried with sterilised gauze sponges. The actual vaccination is carried out in a manner similar to that universally employed in the German Government establishments, already described, with the exception that the parallel lines of incision are discontinuous at intervals of about four inches. Occasionally a certain number of incisions are made at a greater distance from one another, and only a about a couple of inches in length, in order that the condition of the resulting vesicle may be more readily observed. Any blood which exudes from the incisions is removed with sterilised gauze sponges, and then the skin is put on the stretch, while glycerinated lymph is rubbed into each incision by means of a small and thin ivory spatula. The lymph employed consists of one part of vesicle-pulp incorporated with two parts of undiluted glycerine, and the resulting mixture is stored for about a month prior to use.

Collection and Preparation of Lymph.—After the lapse of four days and a half from the time of vaccination, the calf is again placed on the table and the vaccinated area washed with warm boiled water without the addition of any antiseptic. After drying with sterilised gauze sponges, the vesicle-pulp is removed by scraping with a sharp spoon. The resulting pulp is collected in a glass pot provided with a cover, and when all has been removed the total amount is weighed. Sufficient glycerine (undiluted) is then added to cover the mass of pulp, and the vessel and its contents are set aside for a few days. Subsequently, glycerine and water are added in proportions requisite for attaining the following standard :—

Vesicle pulp	1 part.
Glycerine	2 parts.
Water	1 part.

and the mixture is then thoroughly triturated in a mixing machine of the kind invented by Dr. Chalybäus of Dresden. The resulting emulsion is employed for human vaccinations, the "seed material" used for the vaccination of calves, having, as already stated, no water added to it.

Occasionally clamp forceps are employed in the collection of lymph, from the smaller vesicles, when it is required to store it along with glycerine, in fine capillary tubes ; the resulting material, containing comparatively little epithelial tissue, being therefore more readily drawn up

into the tubes. When collection is carried out in this manner the "crust" is first removed from the vesicle which is then gently scraped with a lancet. The material thus obtained is mixed with glycerine in the usual fashion.

The emulsion, which is never sent out for use until at least four weeks after collection of the vesicle pulp, is stored prior to distribution in large glass-stoppered tubes. It is sent out in flaçons, plaques, and capillary tubes, according to the amount required in any given case. The flaçons, small glass tubes made of amber-coloured glass and provided with corks, are of sufficient size to contain enough emulsion for 25, 50, and 100 vaccinations respectively. The plaques consist of two small squares of glass, one of which has a shallow excavation on one surface. This is filled with emulsion, then covered with the plain square, and the edges sealed with paraffin. Quantities of emulsion sufficient for five or ten vaccinations are sent out in this way; while fine capillary tubes which are sealed with paraffin are used for sending out lymph for the vaccination of one person only. All flaçons, plaques, and tubes are sterilised before being filled. In order to send them safely through the post they are enclosed in neat metal cases differing in size and shape. These, together with certain printed matter, including a card to be filled up in accordance with the results obtained from use of the contained lymph are enclosed in a stout glazed orange-coloured envelope secured with a metal clip.

M. Haccius stated that he had, especially of late, experienced some difficulty in getting public vaccinators to fill up and return the cards sent with each consignment of lymph, so that it was not possible to obtain full statistics as to the success attending the use of the lymph sent out from the Institute. On looking over with him, however, a number of cards which had come to hand within the last few months, it appeared that in all cases the success attained was very great; in a not inconsiderable proportion the *insertion* success had reached 100 per cent.

M. Haccius further stated that the structural arrangements of his Institute were the same as when it was first started in 1882, so that they are not in some respects such as would be considered most desirable at the present time. Nevertheless it was impossible not to be impressed with the strict precautions taken to ensure the utmost cleanliness in the case both of the premises and of all persons employed in the various details of the work.

GLYCERINATED CALF VACCINE LYMPH.

PLATE I.

Photograph of tilting table to which the calf is secured for the purpose of vaccination or collection of lymph. The table is in perpendicular position for convenience of strapping the calf to it.

[The Photograph was taken at the Institut Vaccinal, Paris, for MM. Chambon and Ménard.]

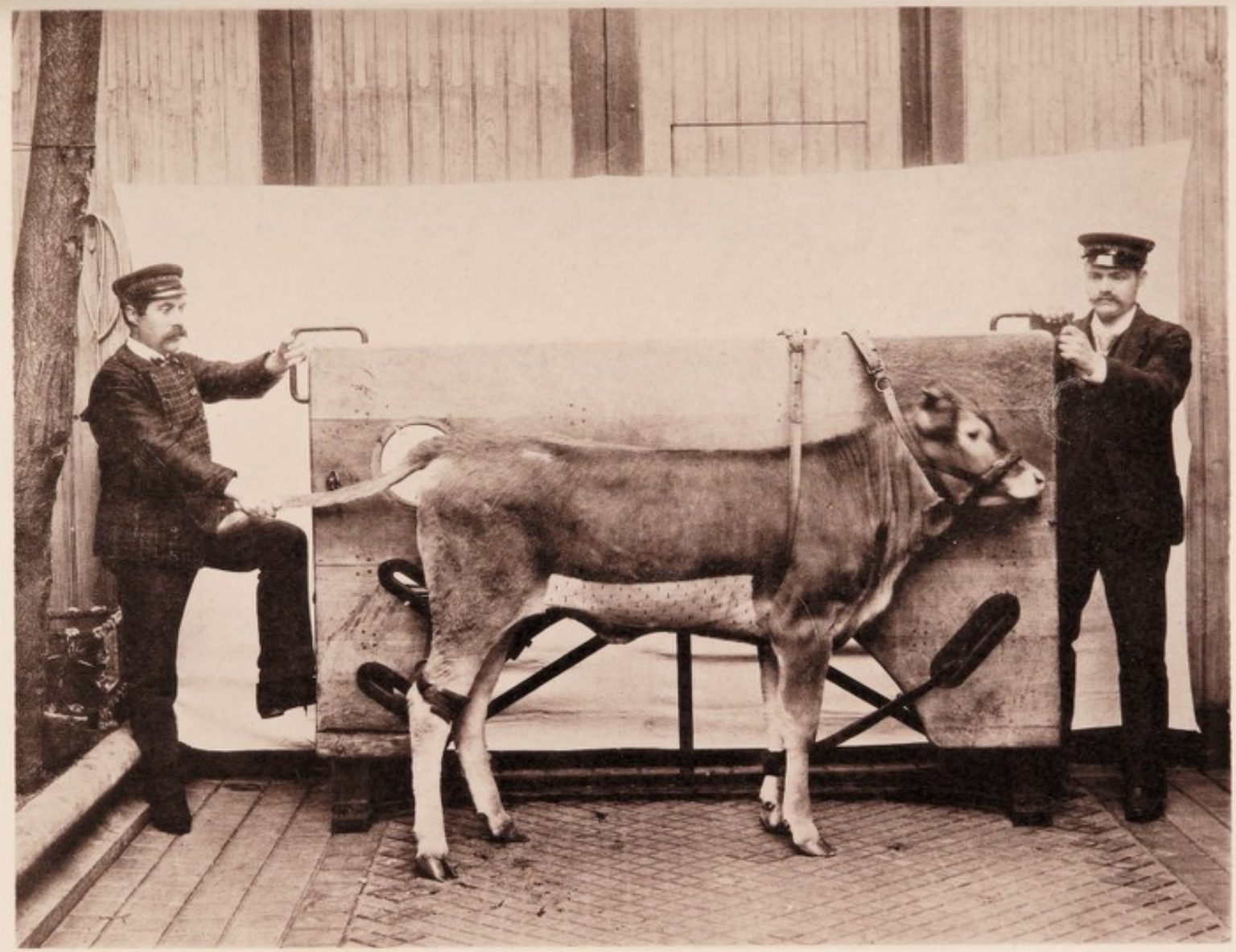
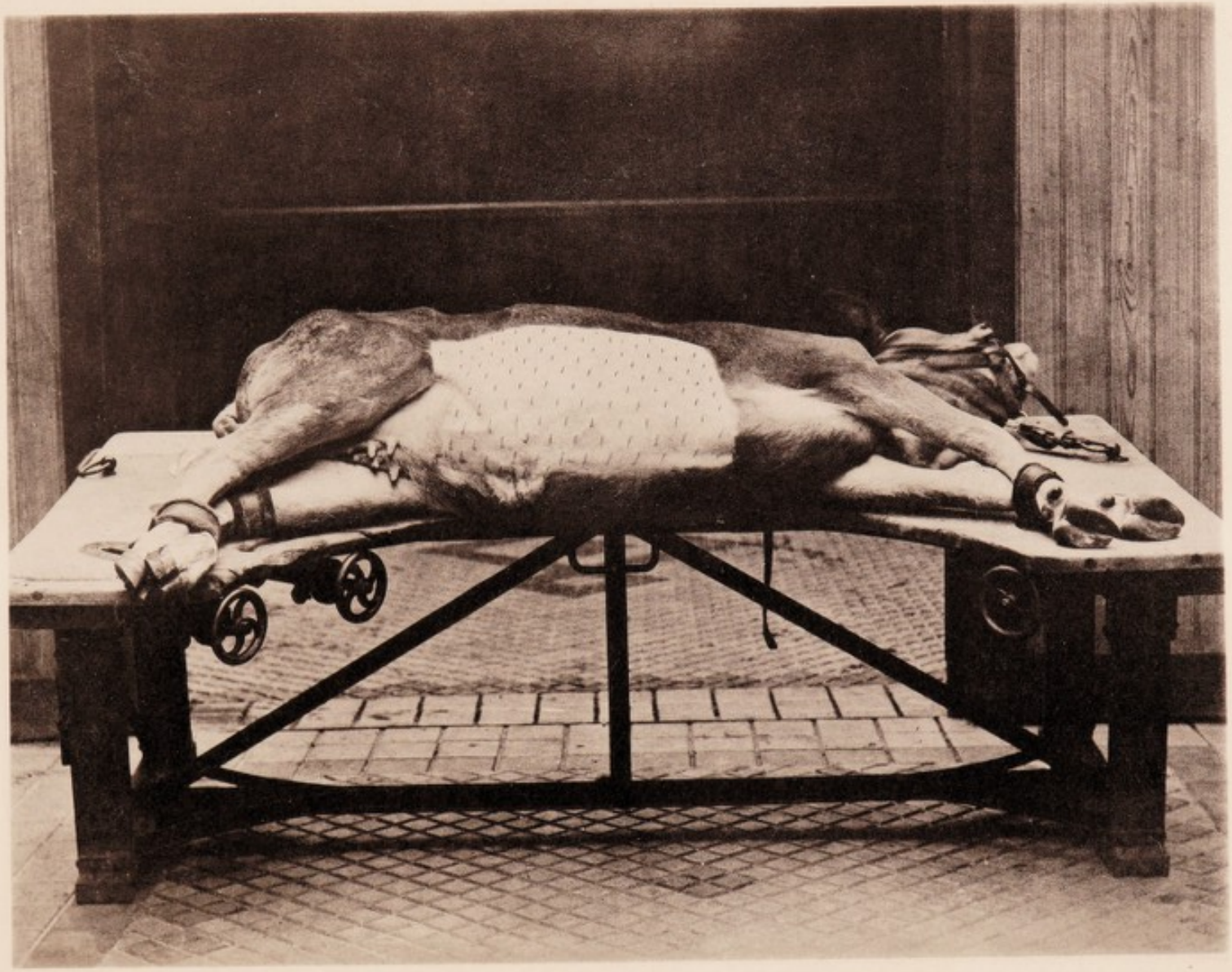


PLATE II.



GLYCERINATED CALF VACCINE LYMPH.

PLATE II.

Photograph of tilting table in the horizontal position, with calf secured to it in readiness, whether for operation or for collection of lymph.

[The Photograph was taken at the Institut Vaccinal, Paris, for MM. Chambon and Ménard.]

In other institutions it is usual for the off hind leg of the calf to be raised, and secured to an iron upright. Such elevation of the leg permits of vaccination on the scrotum, mammary region, and of the inside of the thighs.

GLYCERINATED CALF VACCINE LYMPH.

PLATE III.

Photograph showing process of collection of vaccine lymph from the calf; small quantities only being required, as for instance in connexion with the domiciliary visits to small-pox invaded houses in Paris, described in the text.

[Photograph taken at the Institut Vaccinal, Paris, for MM. Chambon and Ménard.]

PLATE III.

PLATE IV.

GLYCERINATED CALF VACCINE LYMPH.

PLATE IV.

Photograph of the van in which vaccinated calves are transported from MM. Chambon and Ménard's Institution in Paris, to streets in which domiciliary vaccinations are to be performed.

GLYCERINATED CALF VACCINE LYMPH.

PLATE V.

Photograph of Trolley employed in the Cologne Vaccine Institution, on which the carcase of a calf, after slaughter, is brought into the "operating room" for the collection of lymph material.

[Photograph taken for M. Vanselow, the Director of the Cologne Institution.]

PLATE V.

PLATE VI.

GLYCERINATED CALF VACCINE LYMPH.

PLATE VI.

Photograph of hot-air steriliser, in which are a number of large test-tubes, plugged with cotton wool and containing capillary tubes, in which glycerinated lymph is about to be stored. After sterilisation the capillary tubes are retained in the apparatus within the plugged test-tubes until required for use.

[Photograph taken at the Institut Vaccinal, Paris, for MM. Chambon and Ménard.]

GLYCERINATED CALF VACCINE LYMPH.

REPORT

TO THE

LOCAL GOVERNMENT BOARD

ON THE

PREPARATION AND STORAGE

OF

GLYCERINATED CALF VACCINE LYMPH;

WITH AN INTRODUCTION BY THE MEDICAL OFFICER.

Presented to Parliament by Command of Her Majesty.

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