REMARKS ON THE DIFFERENT METHODS OF COLLECTING, PRESERVING, AND EMPLOYING ANIMAL VACCINE.*

By E. WARLOMONT, M.D.,
Director of the Vaccine Institute at Brussels, etc.

In a conference on animal vaccination, held in London on December 4th, 1879, and to which the organ of this Association accorded a wide and friendly publicity, I took particular pains to define the part which, in my opinion, should be attributed to animal vaccination in the prophylaxis of varioloid affections.

To recapitulate, I then said: "Animal vaccination should not pretend to be a substitute for the traditional practice. Arm-to-arm vaccination is, and will yet long remain, strong from its time-honoured rights, the great assistance it gives to the prophylaxis of small-pox, and nothing should be neglected to encourage and regulate it. Animal vaccination should, at the present time, be but its faithful auxiliary, but so useful an auxiliary that it would be as unjustifiable to wish to dispense with it as to wish to suddenly relinquish the clinical practice."

In that communication, I insisted on this point, that the active principle of vaccine, whether animal or humanised, resides in special corpuscles, floating in an inert serosity, and not in the dissolved substances which form the basis of the plasma of the vaccinal serosity, as M. Chauveau has abundantly demonstrated.† These corpuscles, as I at that time pointed out, and as recent researches have confirmed, are nothing but microbes. The special virus of vaccine is, then, inherent in what were termed by M. Chauveau, a dozen years ago, "elementary granules" (*loc. cit.*), which, more recently, MM. Carsten and Overt‡ have named *globular molecules*, and which we shall henceforward designate by the name of *vaccinal microbes*.

The microbes of vaccine float in serum, either isolated or in groups. They seem to be subject to two successive transformations, starting from the coccus to become bacteria—transformations which at the present time are being studied by two Belgian savans, MM. Verriest and Bruylants, who have already published some interesting researches on the microbe of the exudative pleuropneumonia of the bovine species.§ What is known of the microbe of vaccine at the present time is that, during the active period of the vaccine, it is a sporuliform body, uniformly about one-thousandth of a millimetre in diameter. It is smaller, apparently, in vaccine matter obtained from successive culture in the infant of vaccine originally obtained from spontaneous cow-pox, than in calf-lymph; at least, this peculiarity is pointed out by M. Mégnin,|| which I am somewhat inclined to admit. And what, indeed, can be more natural than that an organised body should rather prosper on its native soil than on an adopted one? Another speciality is shown by the examination of the illustrations which accompany M. Mégnin's paper, which is, that the microbes, floating, as a rule, singly in the infantile vaccine lymph, are, on the contrary, rather gathered together in masses in calf-lymph. The illustrations are as follow. Fig. 1. Calf-lymph (second transmission of horse-pox); Fig. 11. Lymph from an infant (collected in a tube).

It is a question whether this varying division of the active corpuscles already exists in the interior of the vaccine vesicle; this scarcely seems to me probable. I am rather inclined to believe that the grouping only takes place after the vaccine has been extracted from the pustule, and that, if this grouping vary in vaccinal lymph of different origin, it must above all be attributed to the varying plasticity of these liquids. I am inclined to think that the microbes float in an isolated fashion in the vaccine lymph contained in the pustule, for the following reasons. It

will doubtless be willingly admitted that, given equal proportions, the lancet of the vaccinator will more readily meet with one or several microbes, if these float in an isolated manner in the liquid, than if they be grouped in masses in some corner. On this rencontre depends the success of the impending vaccination. It is, therefore, incontestable, that vaccinators succeed as well with animal vaccine as with humanised lymph, when both are taken fresh from the pustule; whilst there is a manifest inferiority in those vaccinations which are performed with preserved lymph, in which there is a chance of the microbe escaping the lancet which is seeking it. This also occurs a very few moments after the lymph has quitted its areolæ, which should exclude the idea of referring the phenomenon to a cadaveric change.

Fig. 1.—1. Microbes grouped on an epithelial cell. 2. Microbes grouped. 3. Isolated microbes. 4. Fat globules. 800 diameters.

The methods in use for extracting animal vaccine from the pustule containing it, either to use it on the spot, to send it to a distance, or to preserve it, are—1. The excision of the pustule and the scraping of the under surface; 2. The excision of the pustule in its different stages of development, and its trituration with glycerine; 3. The compression of the pustule with forceps and the deposit of the liquid thus obtained either (a) between plates of glass, (b) on ivory points, or (c) in glass tubes.

Fig. 11.—1. Red blood corpuscles. 2. Albuminous coagulum adhering to one of these globules, and having taken up some microbes. 3. Grouped microbes. 4. Isolated microbes. These are one-fifth smaller than those coming from the heifer.

1. *Excision of the Pustule and the Scraping of the Under Surface.* This is the primitive proceeding. The little tumour is seized in a fold of the skin, and excised with a bistoury slightly curved on the flat. The pustulo-cutaneous fragment thus removed is then taken between the very wide blades of a pair of forceps *ad hoc*, and the inner surface is scraped with a lancet, which deposits on the spot the vaccine thus collected, either under the skin of the patients waiting to be vaccinated, or between two plates of glass, to be preserved or sent away.

* Read in the Section of Public Medicine at the Annual Meeting of the British Medical Association in Cambridge, August 1880.

† "Nature du virus vaccin; nouvelles démonstrations de l'inactivité du plasma de la sérosité vaccinale virulente." (Académie des Sciences, Paris; séance du 17 Février, 1868.)

‡ "La vaccination animale dans les Pays-bas quelques expériences provisoires faites au paré vaccino-gène de la Haye, sur les qualités particulières du virus vaccinal." (Congrès Medical d'Amsterdam, 1879.)

§ Académie royale de médecine de Belgique, séance du 31 Juillet, 1880.

|| "Examen microscopique et comparatif du Horse-pox cultivé sur la genisse, du vaccin de genisse et du vaccin humain frais ou conservé en plaques." (*Journal d'Hygiène*, Paris, 17 Juin, 1880.)

The following method is recommended by M. Negri. He formerly practised it, and may yet do so for aught I know. He took his calf in a little cart through the streets of Naples, stopped before the houses where there was some one to vaccinate, emptied the pustule, and proceeded to the operation. I have tried the process, short of the little carriage and the lymph carried through the town, and I soon left it off. It is not agreeable, causes the animal to lose much blood, and inflicts on it a great deal of useless suffering. It may also be advantageously replaced by other methods. By compressing the pustule with a spring forceps, describing a short radius and, then incising at a depth of one or two millimetres the little tumour, according to its length, the whole of the lymph in it will be expressed even from the deepest part, which, whether rightly or wrongly, M. Negri considers—and, in my opinion, wrongly—as the most active. The same end is attained in this way, but in a more thorough and delicate manner.

Not satisfied with making use of the bloody pustule, excised as above described, certain practitioners, in Italy especially, enclose it between two thick glasses, in a small furrow hollowed out in the thickness of one of them; and send away, to more or less considerable distances, these fragments of flesh, without any further concern, doubtless trusting to the scent of those to whom they are forwarded for the condition in which they arrive. The following fact shows the danger of this plan. On the 22nd of April last, the municipality of San Jeirino d'Oreca had asked a vaccination committee at Rome for a supply of vaccine, which arrived on the 24th. Although the vaccinators found that the vaccineous vesicles sent exhaled a musty (*mucido*) odour, they still used them to vaccinate thirty-eight children—all under twenty months old. If they had tried to sow septicæmia, they could not have taken a better method; and, as a matter of fact, what they were expecting the development of vaccine vesicles, they witnessed the advent of serious disturbances; extensive phlegmons, detaching the muscles and penetrating into the joints, osteomyelitis, etc. The use, then, of these excised pustules, if not on the spot (and even then they may be advantageously replaced by other methods) is absolutely to be avoided; and it can scarcely be understood how thoughtful men can still have recourse to the plan.

2. *Excision of the Pustule in its Different States of Development, and its Trituration with Glycerine.*—This is the method employed by certain Italian committees; the *magma* thus obtained is found in the vaccine which has been widely diffused under the name of "Milan vaccine", with the appearance of a brown marmalade, like the preparation called by confectioners "quince jelly". It is sent out in quills made from old pens—a primitive plan, but as economical as it is convenient. At the moment of using, a certain quantity of it is moistened with glycerine or water. The liquid thus obtained is turbid and lactescent. If it be sold retail, as has been the practice for some years past, the Bureau d'Hygiène at Brussels, this more or less thick solution is placed between two plates of glass, and is sent out to vaccinators.

The paste thus prepared has incontestable advantages; it certainly contains all the active principles of vaccine; and at the same time, it contains a great detritus, this detritus is withheld from septicæmic evolution by mixture with the glycerine. Septicæmic bubbles may, indeed, be deposited therein; but they never multiply. I have used this vaccine paste, received on several occasions from the Milan Committee, or prepared by myself; and I have been able to ascertain, on the one hand, that it is efficacious; and, on the other, that it retains its activity for several weeks. I have only discovered the peculiarity, that the vesicles obtained by its use have always had a phlegmonous character. To let it not be said that we complain of a morbide, but only of hereditary taints. This phlegmonous character is itself in all the subjects, calves or infants, on which the Milan vaccine has been used; so that I have not been able to introduce this method of sale into the Belgian Institut Vaccinal de l'Etat, although it is a thoroughly economical. In my opinion, the lactescent liquid obtained under the skin contains in suspension a large proportion of foreign bodies, which, although in my estimation they are not harmful from a septicæmic stand-point, are none the less foreign bodies performing the part of a thorn, whence the inflammation of the surrounding skin, giving a fermenting aspect to the vesicles thus obtained. It may be added that this paste (the nature of which is to a certain extent unknown) and its milky solution, are of such an appearance as to be hidden between two plates of glass, instead of being placed in indistinctly transparent tubes, as amber Rhine wine is served in green glasses to conceal its unpopular colour. This paste, I repeat, has not an agreeable appearance. This is unquestionably a matter of detail; but I am of opinion that in the question of vaccination, where it concerns passing a foreign substance under the epidermis, it is of importance that matter, like Cæsar's wife, should be above suspicion. Medical men and relatives are extremely exacting on this point, and their scruples should certainly be respected;

and it is on this account that I have entirely given up the Milanese plan.

3. *Compression of the Vesicle by Means of Expressing-Forceps.*—When a vaccine vesicle on an infant is opened on the eighth day of the eruption, with a light hand, by a lancet or a vaccine-needle, some globules of a

Fig. 3.—Expressing Forceps.

perfectly transparent matter exude. The process is different in the pocks on the heifer, from which the vaccine-lymph does not issue spontaneously after it is opened superficially with punctures, like the human vesicle; it only gives issue to blood. To ensure the appearance of the vaccine, it must be squeezed out, which is done by means of the forceps shewn in Fig. 3. This instrument prevents the blood or serous matter of the adjacent parts from reaching the pustule, either at its base or sides; and it may be incised when the slide is sufficiently narrow, when only the required liquid will flow out. If care be taken to remove quickly with a pocket-handkerchief, at the moment the slide is brought together, the surface of the tumour, to remove the layers of epidermis and sometimes a little blood which are found there, the liquid expressed is perfectly clear. If it do not flow abundantly, an incision of about a millimètre deep, parallel to the blades of the forceps, is made.

The different methods in use for abstracting, preserving, and sending out this vaccine, are the following.

a. *Plates of Glass.*—This method, whether applied to human or to animal vaccine, is a relic of the past, and has a share of the defects of all the other methods put together. The vaccine thus confined in the liquid condition is, notwithstanding all efforts to the contrary, exposed to the action of the air, and consequently dies, not without having had to undergo, in the first instance, the maceration of its organisms in the serosity in which they are suspended. These organisms cannot have undergone maceration with impunity; and there is nothing surprising in the fact that most of them die before reaching maturity, or are much deteriorated when they are found still living in the dry material which represents the vaccine, lately placed in a liquid state between the plates. To soften this dry substance, a little warm water is added, which was formerly represented by the moisture of the breath, which, especially in the case of smokers, does not add to the cleanliness of the operation. Midwives are in the habit of using their saliva for the purpose. The use of these plates, still dear to old-fashioned practitioners and midwives, has nothing in its favour but its democratic appearance and the force of tradition. It should be given up, the more especially as it is the most inconvenient form for sending out.

b. *Glass Tubes.*—When a glass tube, open at both ends, is put to the small pool of vaccine obtained by compression, the liquid rushes into the tube. If the pool have been but a few moments exposed to contact with the air, it is no longer the same thing; it becomes coagulated very quickly after exposure, the vaccine heifer-lymph being very plastic. Neither does vaccine lymph taken into tubes escape coagulation; for, after some some hours, it is difficult to extract it; and what is so extracted is essentially unreliable in its action. These circumstances induced me to say at the commencement of my experiments, "If the use of tubes be persisted in, they will be the grave of animal vaccination, unless some means be found of preventing the coagulation of the vaccine". A means of preventing this coagulation is now found—a mechanical means, which does not deprive the vaccine of any of its activity; and our animal vaccine in tubes justly enjoys great popularity. Before being introduced into the tubes, it is defibrinated; a small quantity of glycerine is added to it, so as to preserve it from all consecutive change when it is not required to be used before five days. When it is to be used soon after collection, this addition may be dispensed with.

A noteworthy fact is the tendency of the microbes to draw towards the sides of the tube and adhere to it. If the tube be simply emptied by blowing through one end, many of these active agents remain fixed

to the glass. Before emptying the tubes, they should be rolled sharply between the forefinger and thumb, so as to make them discharge the whole of their contents, vehicle and microbes. In order to prevent the too direct action of light on the vaccine matter, we now use amber glass tubes.

c. Ivory Points.—The small ivory plates on which the animal vaccine is deposited are square at one end and pointed at the other. The pointed end is presented to the pool of vaccine squeezed out by the forceps, so as to charge it with lymph. It is afterwards quickly dried by the heat of the sun, or a clear fire at heat not exceeding 104 Fahr. When the point is heavily charged, it becomes dry at the end of fifteen or twenty minutes; the whole of the serous matter is evaporated, and nothing remains on the point but dried lymph, deprived of all humidity likely to macerate the active principles. Animal vaccine keeps for a long time in this shape. To prevent the porous nature of the ivory from absorbing a large part of the matter deposited on it, the points should be of a hard-grained ivory, and highly polished. Under these conditions, if the first layer have been widely distributed, it is absolutely useless to cover it with a second, as was formerly the practice. At the present time, the American points are highly esteemed. The points are sufficiently sharp to introduce the virus under the skin. These points are beautifully made, and I therefore give them the preference over all others;* but for the erosion of the skin, I always prefer metallic instruments.

Method of Employing Animal Vaccine.—As I have already said, vaccination with living vaccine, whether human or animal, succeeds at once, even when performed by simple puncture, if the operator know how to obtain the conditions necessary to ensure success; *i. e.*, vaccine taken at the required moment from good vesicles; the introduction of this vaccine under the skin without any flow of blood, etc. This is because evidently at this moment the microbes are in the enjoyment of their full vitality. They are uniformly diffused, and in isolation in their vehicle, without being able to escape the lancet of the vaccinator who goes direct to the pustule.

It is not so with preserved lymph. Many of the microbes have perished; those which have resisted have collected into groups, as if to say, "Union is strength". In order to have some chance of a good result, it becomes necessary to expend a much larger quantity of vaccine matter, and to introduce it by large and exposed openings; hence the scarification method, which I have recommended for the last fifteen years. Whether vaccine in tubes or vaccine on points be used, the object is that the vaccine should reach its destination with certainty and in sufficient quantity on contact with the dermis; and this end is obtained by the plan here recommended. After having drawn the skin tight, three scarifications about four millimetres in length each, not going deeper than the skin, and about one millimetre apart from each other are made; and it is on this group of scarifications, three of them being made at two centimetres apart, that the vaccine is diffused. If it be in tubes, it is enough to deposit it. If it be on points, they are first quickly plunged into warm water; and, after being taken out and the dried vaccine allowed time to soften, they are placed on the wound, well dried, and laid flat, and for a long time, until the ivory is completely freed from the vaccine with which it was covered. If a little blood be mixed with it, the whole is brought together on small groups of incisions and allowed to dry. Doubtless, nothing is more simple than to make these little scarifications; and yet, whether it be that their hand trembles, their sight deceives them, or routine misleads them, many old practitioners make them very badly, and the midwives still worse. The incisions they make are too long, or too deep, or too far apart; the blood flows; and the vaccination sometimes is accompanied by a wound which it is very easy to avoid, and sometimes is a total failure: the virus having been carried away by the hæmorrhage. It is for the purpose of regulating this little operation that I have invented the *vaccinator trephine*. (Fig. 4.) It comprises a circular blade two centimetres in diameter, enclosed in a cylindrical frame, to which a rotatory movement is imparted by the working of an internal spring. Applied closely to the tightly stretched skin, it suffices to apply the end of the index finger quickly to the button, to put in action the blade, which traces with lightning rapidity an annular furrow in proportion to the projection of the blade—a projection which is increased or lessened by turning the surrounding ferule round, giving it a backward turn. For infants with delicate skins, the blade should scarcely go beyond the level of the ferule. The incision made, the vaccine is applied in the usual way. It has been objected, that this instrument frightens the children, is difficult to apply, etc. Those who express these opinions have, how-

ever, never seen it in operation. It is no more difficult to make a correct incision with the trephine than to put a dot to an *i*.

Fig. 4.—Vaccinator Trephine.

The conclusions at which I have arrived, then, are these. 1. The active principle of the vaccine is present in special corpuscles floating in an isolated manner in an inert serous matter. Everything tends to establish the conclusion that these corpuscles are animated germs. 2. These corpuscles float in an isolated manner in the vaccine contained in the pustule; they are collected in groups in animal vaccine which has been extracted at a more or less distant period. 3. The excision of the pustule, and the scraping of its under surface to obtain the vaccine matter; the ablation of the pock, and its trituration with glycerine, as in the Milanese method; the preservation of vaccine between plates of glass,—are imperfect methods. 4. The extraction of the vaccine from the animal pock by means of compressing forceps, the introduction of this matter defibrinated in capillary tubes, or its deposit on ivory tubes, are excellent, elegant, and practical methods. 5. Fresh animal vaccine may be introduced by punctures; the preserved should be introduced by sufficiently large scarifications of the skin.

ON AN APPARATUS FOR TREATMENT OF FRACTURES OF THE PATELLA WITH SEPARATION.

By W. I. WHEELER,

Master of Surgery of the Dublin University; Fellow of the Royal College of Surgeons, and Member of Council; Surgeon to the City of Dublin Hospital.

SOME years ago I brought under the notice of the Surgical Society in Ireland a splint for the treatment of fractures of the patella with separation, being a subject which had much occupied my attention, and from the knowledge that there was considerable difference of surgical opinion as to the most efficient way of adjusting the fragments—many, like myself, up to this time considering no method satisfactory—exemplified by the numerous plans advocated, from position, Malgaigne's hooks, and the recent appliances well illustrated in Professor Agnew's *Surgery*, to opening the joint and stitching the fragments together. Last year I was able to record the results of many cases treated by this apparatus, and to exhibit a specimen of osseous union.

In this discourse I allude to that most common form of fractured patella, in which separation between a superior and inferior fragment occurs. As can be observed, the apparatus which I use is a hollow wooden splint (Fig. 1) extending from above the middle of the thigh to the sole of the foot, at which point a foot-board (E) is attached by means of a hinge. This splint having two transverse bars, is fitted into a long box splint, in the sides of which it travels horizontally. That portion of the splint on which the limb rests can be elevated or de-

* These points are manufactured at Boston,* and can be had by writing to Dr. Martin, 27, Dudley Street, Boston, U.S.A.