V. VACCINIA (*Cow-pox*)—VACCINATION.

Definition.—An eruptive disease of the cow, the virus of which, inoculated into man (vaccination), produces a local pock with constitutional disturbance, which affords protection, more or less permanent, from small-pox.

The vaccine is got either directly from the calf—animal lymph—in which the disease is propagated at regular stations, or is obtained from persons vaccinated (humanised lymph).

It was in 1798 that Edward Jenner, a friend and pupil of Hunter, practising in Gloucestershire, announced that persons accidentally inoculated with the cow-pox were subsequently insusceptible to small-pox. From that time the process has extended over the civilized world and proved an incalculable boon to humanity. For many years arm-to-arm vaccination was practised, or the lymph was collected from the vesicle of a child, or the dried scabs were used. The humanised lymph in all probability underwent changes and was certainly more frequently followed by evil results. Of late years animal vaccination has superseded it in great part, and now the lymph is derived either directly from the calf or from one or two removes.

The precise nature of the vaccination virus is as yet unknown. Several forms of micro-organisms have been isolated, and Quist has cultivated micrococci which, he states, produce in the child a typical vaccine vesicle. Several attempts have since been made to isolate the virus, but without definite success. Ernst and Martin, of Boston, have isolated from the bovine lymph a germ which grows on culture media and produces, when inoculated in the calf or in children, characteristic vesicles.

Phenomena of Vaccination.—In a primary vaccination, at the end of twenty-four or thirty-six hours there is seen at the point of insertion of the virus a slight papular elevation surrounded by a reddish zone. The papule gradually increases and on the fifth or sixth day shows a definite vesicle, the margins of which are raised while the centre is depressed. By the eighth day the vesicle has attained its maximum size. It is round and distended with a limpid fluid, the margin hard and prominent, and the umbilication is more distinct. By the tenth day the vesicle is still large and is surrounded by an extensive areola. The skin is also swollen, indurated, and often painful. On the eleventh or twelfth day the hyperæmia diminishes, the lymph becomes more opaque and begins to dry. By the end of the second week the vesicle is converted into a brownish scab which gradually becomes dry and hard, and in about a week (that is, about the twenty-first or twenty-fifth day from the vaccination) separates and leaves a circular pitted scar. If the points of inoculation have been close together, the vesicles fuse and may form a large combined vesicle. Constitutional symptoms of a more or less marked degree follow the vaccination. Usually on the third or fourth day the temperature rises, and may persist, increasing until the eighth or ninth day. In children it is common

to have with the fever restlessness, particularly at night, and irritability; but as a rule these symptoms are trivial. If the inoculation is made on the arm, the axillary glands become large and sore; if on the leg, the inguinal glands. The above may be taken as representing the typical course of vaccination, whether performed with the humanised or with the animal lymph.

Successful vaccination is, for a time at least, an infallible protection against small-pox. The duration of the immunity is extremely variable, differing in different individuals. In some instances it is permanent, but a majority of persons within ten or twelve years again become susceptible.

Revaccination should be performed between the tenth and fifteenth year, and whenever small-pox is epidemic. The susceptibility to revaccination is curiously variable, and when small-pox is prevalent it is not well, if unsuccessful, to be content with a single attempt. The vesicle in revaccination is usually smaller, has less induration and hyperæmia, and the resulting scar is less perfect. Particular care should be taken to watch the vesicle of revaccination, as it not infrequently happens that a spurious pock is formed, which reaches its height early and dries to a scab by the eighth or ninth day. The constitutional symptoms in revaccination are sometimes quite severe.

An irregular course is uncommon in primary vaccination, but we occasionally meet with instances in which the vesicle develops rapidly with much itching, has not the characteristic flattened appearance, the lymph early becomes opaque, and the crust forms by the seventh or eighth day. In such cases the operation should again be performed with fresh lymph.

Complications.—In unhealthy subjects, or as a result of uncleanliness, or sometimes injury, the vesicles inflame and deep excavated ulcers result. Sloughing and deep cellulitis may follow. In debilitated children there may be with this a purpuric rash. Erysipelas may occur, or there may be deep gangrenous ulceration. Such instances are rare, but I have seen two which proved fatal. In one there was deep sloughing and in the other erysipelas. Cases of local dermatitis must not be mistaken for erysipelas. Among the most common complications are certain skin eruptions, some of which are due to the vaccine virus; others result from a mixed infection. Vaccine vesicles not infrequently break out in the immediate vicinity of the primary sores. Less commonly there is a general eruption of vesicles—generalized vaccinia—due to absorption of the virus. More frequent, perhaps, is the erythematous or roseolous rash. Contagious impetigo can also be inoculated with the virus, and may appear as a general eruption.

A question of special importance with reference to vaccination is the transmission of other diseases. For a time physicians were unwilling to acknowledge that constitutional disorders could be transmitted by vaccination, but it is now universally recognized that such transmission may take place, and this has emphasised the scrupulous care which should be taken in the performance of the operation.

Vaccino-Syphilis.—For a knowledge of this most serious of all accidents during vaccination we are largely indebted to Jonathan Hutchinson. It is a true instance of a mixed infection. The vaccine vesicles take as a rule their usual course, and it is not until they have healed or are in process of healing that the local changes characteristic of syphilis are manifested. The fact that syphilis may be transmitted in this way should put the practitioner on his guard in selecting humanised lymph. He should take it only from subjects with whose constitution he is perfectly familiar. Fortunately, the instances are extremely rare. They are, in fact, much less frequent than is usually supposed, and in a majority of the cases in which vaccino-syphilis is suspected the condition is really that of inflamed and indurated vaccinal ulcer. As the subject is of daily interest to the practitioner, and one which he may at any moment be called upon to decide, I here insert a table of differential features between vaccinal ulcers and vaccino-syphilis, and between the vaccination rashes and the secondary syphilitic eruptions, compiled by C. E. Shelly * from Fournier's lectures.

VACCINO-SYPHILIS.	VACCINATION ULCERS.
Chancre developed on the site of usually one or two only of the vaccination punctures.	Ulceration affects all the punctures as a rule.
Inflammation is slight.	Inflammation and ulceration severe.
Loss of substance superficial only.	Ulcer deeply excavated.
Suppuration scanty or absent, scabs or crusts formed.	Much suppuration.
Border of chancre smooth, slightly elevated, gradually merging into floor.	Margin of ulcer irregular, as in "soft chancre."
Surface of floor smooth.	Floor of ulcer uneven, suppurating.
Induration "parchment-like" and specific, not merely inflammatory.	Induration inflammatory only.
Inflammatory areola very slight.	Areola inflammatory and erysipelatous in character.
Gland swelling constant, indolent (syphilitic) bubo.	Gland swelling often absent; if present, merely inflammatory.
Complications rare.	Complications—sloughing, erysipelas, etc.—often present.
Chancre never developed before the fifteenth day after vaccination; usually not until after three to five weeks; still in its earlier stage twenty days after vaccination.	Ulceration is present twelve or fifteen days after vaccination and is fully developed by the twentieth day after vaccination.

* Fowler's Dictionary of Medicine. Article Vaccination.

SECONDARY SYPHILITIC ERUPTION	VACCINATION RASHES
due to true vaccino-syphilis.	(including roseola vaccinalis, miliaria vaccinalis, vaccinia bullosa, vaccinia hæmorrhagica); also accidental eruptions—rubeola, scarlatina, lichen, urticaria, etc.
Appears, at the earliest, nine or ten weeks after vaccination.	A true vaccinal rash appears between the ninth and fifteenth day after vaccination.
Requires, in every case, the pre-existence of a specific ulcer (chancre) at the site of vaccination.	Absence of inoculation chancre.
Exhibits the characters of a true specific eruption.	Eruption does not exhibit specific characters.
Fever often slight.	Fever always present.
Lasts for a long time.	Evanescent.
Usually accompanied by specific appearances on mucous membranes.	

VACCINO-SYPHILIS.	HEREDITARY SYPHILIS SHOWING ITSELF ABOUT THE TIME OF VACCINATION.
Begins with a local infection, chancre and indolent bubo.	No chancre; begins with general phenomena.
Typical development in four stages, viz., incubation, chancre, second incubation, generalization (secondary eruptions, etc.).	Has no typical development in connection with vaccination.
Never appears earlier than the ninth or tenth week after vaccination.	Time of development quite independent of vaccination.
	Is attended by the characteristic syphilitic bodily aspect.
	Other manifestations of hereditary syphilis may be present.
	The history may indicate syphilis.

Choice of Lymph.—Humanised lymph should be taken on the eighth day and only from perfectly formed unbroken vesicles, which have had a typical course, and have not yet developed areolæ. Pricking or scratching the surface, the greatest care being taken not to draw blood, allows the lymph to exude, and it may then be collected on ivory points or in capillary tubes. The child from which the lymph is taken should be healthy, strong, and known to be of good stock, free from tuberculous or syphilitic taint. Under these circumstances humanised lymph, one or

two removes from the calf, is usually very satisfactory in its action and is perfectly reliable.

In the case of the calf the most scrupulous care should be exercised in the vaccine farms to secure animals which are healthy and strong. The risk, however, that the calf has any disease which can be transmitted to man is exceedingly slight, as tuberculosis is very rare in cattle when young. Unquestionably, however, there may be risk in the case of a calf born of tuberculous parents, and special care should be taken in the selection of proper animals. There is no essential difference in the pocks which follow humanised lymph and bovine lymph. It was, I believe, a common experience in Montreal that children inoculated with bovine lymph had more constitutional disturbance and often sorer arms than those vaccinated with humanised lymph at one or two removes.

In the performance of the operation that part of the arm about the insertion of the deltoid is usually selected. Mothers "in society" prefer to have girl babies vaccinated on the leg. The skin should be cleansed and put upon the stretch. Then, with a lancet or the ivory point, cross-scratches should be made in one or more places. When the lymph has dried on the points it is best to moisten it in warm water. The clothing of the child should not be adjusted until the spot has dried, and it should be protected for a day or two with lint or a soft handkerchief. If erysipelas is prevalent, or if there are cases of suppuration in the same house, it is well to apply a pad of antiseptic cotton. Vaccination is usually performed at the second or third month. If unsuccessful, it should be repeated from time to time. A person exposed to the contagion of small-pox should always be revaccinated. This, if successful, will usually protect; but not always, as there are many instances in which, though the vaccination takes, variola also appears.

The Value of Vaccination.—Vaccination is not claimed to be an invariable and permanent preventive of small-pox, but in an immense majority of cases successful inoculation renders the person for many years insusceptible. Communities in which vaccination and revaccination are thoroughly and systematically carried out are those in which small-pox has the fewest victims. On the other hand communities in which vaccination and revaccination are persistently neglected are those in which epidemics are most prevalent. In the German army the practice of revaccination has stamped out the disease. Nothing in recent times has been more instructive in this connection than the fatal statistics of Montreal. The epidemic which started in 1870–'71 was severe in Lower Canada, and persisted in Montreal until 1875. A great deal of feeling had been aroused among the French Canadians by the occurrence of several serious cases of ulceration, possibly of syphilitic disease, following vaccination; and several agitators, among them a French physician of some standing, aroused a popular and wide-spread prejudice against the practice. There were indeed vaccination riots. The introduction of animal lymph was distinctly

beneficial in extending the practice among the lower classes, but compulsory vaccination could not be carried out. Between the years 1876 and 1884 a considerable unprotected population grew up and the materials were ripe for an extensive epidemic. The soil had been prepared with the greatest care and it only needed the introduction of the seed, which in due time came as already stated with the Pullman-car conductor from Chicago, on the 28th of February, 1885. Within the next ten months thousands of persons were stricken with the disease, and 3,164 died.

Although the effects of a single vaccination may wear out, as we say, and the individual again become susceptible to small-pox, yet the mortality in such cases is very much lower than in persons who have never been vaccinated. The mortality in persons who have been vaccinated is from 6 to 8 per cent, whereas in the unvaccinated it is at least 35 per cent. Marson pointed out some years ago that there is a definite ratio between the number of deaths and the number of good vaccination marks in post-vaccinal small-pox. With good marks the mortality is between 3 and 4 per cent, and with indifferent marks at least 10 or 11 per cent.

VI. VARICELLA (*Chicken-pox*).

Definition.—An acute contagious disease of children, characterised by an eruption of vesicles on the skin.

Etiology.—The disease occurs in epidemics, but sporadic cases are also met with. It may prevail at the same time as small-pox or may follow or precede epidemics of this disease. An attack of chicken-pox is no protection against small-pox. It is a disease of childhood; a majority of the cases occur between the second and sixth years. It is rarely seen in adults. The bacteriological examination of the vesicles has shown the presence of micrococci in the contents of the vesicles, but the specific germ has not yet been discovered.

There can be no question that varicella is an affection quite distinct from variola and without at present any relation whatever to it. An attack of the one does not confer immunity from an attack of the other. The case which Sharkey reported is of special importance in this connection. A boy, aged five, was admitted to St. Thomas' Hospital with a vesicular eruption, and was isolated in a ward on the same floor as the small-pox ward. The disease was pronounced chicken-pox, however, by Sir Risdon Bennett and Dr. Bristowe. The patient was then removed and vaccinated, with a result of four vesicles which ran a pretty normal course. On the eighth day from the vaccination the child became feverish. On the following day the papules appeared and the child had a well-developed attack of small-pox with secondary fever.

Symptoms.—After a period of incubation of ten or fifteen days the child becomes feverish and in some instances has a slight chill. There