hand in hand with a corresponding improvement of the product, is at the source—where it is made.

In conclusion, I may say that the vaccine is but one of three factors which determine the success or failure of vaccination. The others are a satisfactory inoculation technique and the proper care of the wound afterward. These important factors are to be discussed by those who are to follow me on this program.

The following are some of the more recent publications referred to in the text:

1. Ch. Haccius. Variola vaccine. Contribution à l'étude des rapports qui existent entre la variole et la vaccine. Geneva, 1892.
2. Die Thätigkeit der im Deutschen Reiche errichteten staatlichen Anstalten zur Gewinnung von Thierlymphe während des Jahres, 1900. Berlin, Springer.
3. Bericht über die Impfstofffrage. Berichterstatter: Dr. P. Frosch. Berlin, 1896.
4. Zweiter Bericht. Berichterstatter: Vanselow und Freyer. Vierteljahrsschrift für gerichtliche Medizin u. öffentliches Sanitätswesen. 1899, xvii, 93.
5. M. J. Rosenau. Dry points versus glycerinated virus from a bacteriologic standpoint. American Medicine, 1902, iii, 637.
6. G. Paul. Ueber einige Fortschritte in der Gewinnung des tierischen Impfstoffes und der Aseptic der Schutzpockenimpfung. Wiener med. Presse, 1898, p. 129.
7. R. N. Willson. An analysis of fifty-two cases of tetanus following vaccination. Journal American Medical Association, 1902, xxxviii, 1147, 1222.
8. Joseph McFarland. Tetanus and vaccination. An analysis of ninety-five cases of this rare complication. Journal Medical Research, 1902, vii, 474.
9. Huddleston. Medical Record, March 8, 1902.

VACCINATION: THE TECHNIQUE.¹

BY EUGENE A. DARLING, M.D., CAMBRIDGE, MASS.

THE two considerations which govern the technique of vaccination are that the operation shall be successful and that it shall be safe. Danger may come from the use of impure lymph, from unsuitable conditions in the patient, from infection at the time of the operation or during the development of the vesicle. A description of the technique therefore divides itself into four parts, as follows: (1) The selection of the lymph; (2) the condition of the patient; (3) the operation; (4) the after-treatment.

(1) *The selection of the lymph.*—This is perhaps the most important factor of all as regards both success and safety, and yet it is the one condition which is beyond the control of the physician. It is well recognized by bacteriologists that lymph taken directly from the vesicles on the calf contains many contaminating bacteria. When the lymph is dispensed dried on bone points a large proportion of these bacteria remain active. Probably most of them are harmless, yet the common occurrence of the pyogenic staphylococci and streptococci in lymph so dispensed constitutes a real danger. The use of glycerine as a slow bactericide has undoubtedly much diminished, if it has not wholly abolished the danger from this source; but the glycerinated lymph has certain disadvantages which have prevented its universal adoption, and many physicians still prefer the old unpurified lymph. The disadvantages of glycerinated lymph are the slowness with which it dries, and the difficulty

which some have in making it "take." The latter may be due to too great dilution, since there are considerable variations in the proportion of successful vaccinations from different lots of lymph from the same source. However, with care in the insertion of the lymph and with proper protection while drying, the percentage of successful insertions may be very satisfactory, if not the 100% claimed by some producers.

In the absence of any feasible method of supervision by the health authorities, and of any practical test of the efficiency and purity of any given lymph short of actual inoculation of a susceptible individual, there must always be an element of uncertainty as to the care exercised in its preparation. There is no reason to doubt that many of the lymphs now on the market are prepared with due precautions, but this is certainly not true of all, and the physician has no means of discrimination. The State compels the child to be vaccinated, and should furnish the lymph for the operation, guaranteed to be pure and efficient. The reasons which justify the manufacture of diphtheria antitoxin by the State apply with even greater force to the production of vaccine lymph, and it is to be hoped that the present movement to place the control of this important matter in the hands of the State Board of Health will succeed.

(2) *The condition of the patient.*—The best age for the primary vaccination of healthy children is between three and six months, that is, after the child is well started in life and before it has begun the troublesome process of teething. At this period the constitutional disturbance is milder, as a rule, and the care of the child is much simpler than at a later age. In the case of delicate children, or of those suffering from some constitutional disease, the vaccination may be postponed at the discretion of the physician. Vaccination is contra-indicated when the child is suffering from any inflammatory skin disease, such as erysipelas or eczema, or when it has recently been exposed to any acute infectious disease, such as scarlet fever, measles, mumps or whooping cough. In time of epidemic, or when there has been an actual exposure to smallpox, vaccination may be performed as early as the first week of life, or in the face of circumstances which would ordinarily contra-indicate it, but in individual cases the decision as to its advisability must be left to the judgment of the attending physician.

There is considerable difference of opinion as to the proper time which should elapse before revaccination. In most cases children who have been vaccinated in infancy cannot be revaccinated successfully until after a period of eight or ten years. In Germany, where the matter has been regulated with great care, the law requires vaccination in infancy and revaccination at the age of twelve. The almost complete immunity from smallpox which Germany has enjoyed since the enactment of this law is attributed largely to the compulsory revaccination, and it is reasonable,

¹ Read before The Massachusetts Medical Society, June 10, 1902.

therefore, to recommend this practice. After two successful vaccinations it is not necessary to repeat the operation except in times of epidemic, when universal revaccination should be insisted upon. The plan which has been suggested, of repeating the vaccination at stated intervals, until there is complete insusceptibility, is theoretically correct, but is practically too drastic to be enforced, except in the case of physicians and nurses who are thrown into close contact with cases of smallpox.

(3) *The operation.*—The physician should remember that the operation of vaccination, though insignificant in itself, demands the observance of the ordinary rules of surgical asepsis. The hands of the operator and the skin of the patient should be surgically clean, and only a clean sterile instrument should be used for the scarification. With a little care it is possible to perform the operation without touching the skin of the patient with the fingers, and this source of infection may be entirely eliminated. The most convenient place for the insertion is the outer side of the upper arm. There is no objection to vaccinating on the leg in the case of girls, where it is desirable to avoid disfigurement; but in this location the after-treatment requires somewhat greater care to ensure protection and cleanliness. The skin of the patient should be washed thoroughly with soap and water, and afterwards with alcohol or ether, with enough friction to cause some reddening. This removes the superficial layer of the epidermis and dilates the cutaneous vessels, thus aiding in the absorption of the lymph. If there is any hair it is well to shave a small area, but this is rarely necessary. Antiseptics as a rule are not required. For the scarification the best instrument is an ordinary needle, which should be sterilized just before use by heating in an alcohol or Bunsen flame. The lymph may be placed on the skin first, and the scarification done through it, or the skin may first be scratched and the lymph then well rubbed and pricked in, the needle being used for this purpose. It is better to make three or four small insertions than one large one. A scarification no larger than an eighth of an inch in diameter will produce a vesicle and cicatrix from one-quarter to one-half an inch in diameter. When several insertions are made they should be at least an inch apart. If placed too near one another they are liable to coalesce and form a single large vesicle, which is much more likely to be injured than several small ones.

(4) *After-care.*—The arm should preferably be left bare until the lymph has dried. If glycerinated lymph has been used, this may take a considerable time—an hour or more—and in office practice this may cause much inconvenience. When this long wait is impracticable, it is permissible to use a shield for temporary protection. The best shield for this purpose is one of the light linen or paper forms, porous or perforated, and stiff enough to resist crushing. This may be held in place by two or three small strips of

plaster. The shield may be left on for a few hours, and should then invariably be removed. The subsequent dressing should be the simplest compatible with cleanliness and adequate protection. It is sufficient for the first five days to wind a strip of sterilized gauze, or a clean handkerchief, about the arm and hold it in place by pinning it to the under-garment. After the vesicle has formed, this same dressing is still sufficient in most cases. If there is danger of breaking the vesicle, or if the patient is inclined to scratch it, it may be well protected by a cocoon of absorbent cotton and collodion. A very comfortable dressing may be made by using two square pads of folded gauze, one three inches in diameter and the other a little smaller. The larger one has a hole cut in its centre large enough to include the vesicles, and is held in place by two strips of zinc oxide plaster. The smaller pad is then pinned on so as to form a lid over the hole. This dressing has the advantage of permitting the inspection of the vesicles without disturbing it. If the vesicles break down and suppurate, they should be washed daily with boiled water or a mild antiseptic, and kept bandaged with sterilized gauze. If the itching is intolerable, a little aristol or some other mildly antiseptic powder may be dusted on. Occasionally a scab forms having a few drops of pus under it and some edematous granulations. Such a scab should be carefully removed, and the granulations should be cut off with a pair of flat-curved scissors. This proceeding is entirely painless and leaves a clean, healthy surface, which usually heals rapidly under mild antiseptic treatment.

Shields as permanent dressings are to be condemned, without exception. The transparent celluloid ones, which have been used so widely of late, are especially bad. If insufficiently ventilated they confine the perspiration, and this macerates the skin of the enclosed area, making it more or less red and edematous. If the sides are perforated, to allow the free access of air, lint is rubbed off from the inside of the undershirt and accumulates inside the shield. Sometimes this lint forms a feathery mass, looking much like a growth of mould. It is, of course, not sterile. Furthermore, the circle of plaster, which is employed to hold the shield in position, is very irritating to delicate skins, and often causes an eczematous eruption which greatly increases the discomfort of the patient. The only advantage which shields possess is their stiffness, which affords more protection against injury to the vesicles than a simple bandage, but this advantage is wholly counterbalanced by the disadvantages mentioned.

The simpler the after-treatment, the more likely it is to be carried out. The physician should always give detailed instructions to the patient, or, if the latter is a child, to the parents or nurse. This precaution is often neglected by the busy practitioner, or the instructions given are so general as to be of little value. Emphasis should be placed on the importance of cleanliness and pro-

tection from injury. The patient should be warned not to scratch the arm nor to prick the vesicles. He should also be cautioned not to apply vaseline or any other greasy substance to relieve the itching, as this softens the epidermis and may cause the vesicles to break down and suppurate. Ignorance and carelessness on the part of some patients are unavoidable, but personal attention to details on the part of the physician will do much to obviate this source of danger. The responsibility resting upon the physician in this matter is not a light one. If mishaps occur he is always blamed, whether justly or not. The sources of danger, as already pointed out, are not entirely under his control, but it is his duty, as well as his interest, to observe every precaution which will minimize the danger of vaccination, and yet afford his patients that immunity from smallpox which is one of the greatest blessings conferred on mankind by the art of medicine.

DISCUSSION.

Dr. J. H. McCOLLOM of Boston: I heartily coincide with Dr. Darling's ideas, and it seems to me that he has brought out some very interesting points.

Having had a large experience, both before and after the epidemic of last fall and winter, I must confess that I think the majority of sore arms are due not so much to the carelessness of the individual, as to the physician in not giving sufficient directions.

VACCINATIONS: ACCIDENTS AND UN-TOWARD EFFECTS.¹

By JOHN H. MCCOLLOM, M.D., BOSTON.

In this paper no attempt will be made to prove the protective power of vaccination, a self-evident proposition, neither will anything be said regarding the technique of vaccination, these subjects having been ably treated in other papers presented to the society today. It must be taken for granted that vaccination is an operation, and that any operation, no matter how slight, may be followed by injurious effects, if there is carelessness in its performance or in the subsequent care of the wound. When we take into account the immense number of individuals vaccinated each year and the remarkable rarity of any serious results, the wonder is, if vaccination is such an injurious procedure as is claimed by its opponents, that there are not more disastrous effects. Many of the alleged injurious effects after careful investigation have been proved to have no connection with vaccination either directly or indirectly, but have been shown to be due to carelessness on the part of the individual.

It has been alleged that syphilis is frequently caused by vaccination. While this may have been possible in certain rare instances when humanized lymph was used, it is impossible when bovine lymph is employed. It has happened to the writer in several instances to investigate alleged occurrences of communication of syphilis, but in each case careful investigation revealed

the fact that the individuals were suffering from the primary lesion of syphilis at the time they were vaccinated, and that vaccination was used as a cloak to cover this condition. As an illustration of the manner in which vaccination is unjustly accused of conveying syphilis, Dr. Cory, in his "Theory and Practice of Vaccination," describes very aptly the following case of a child whose father contracted syphilis shortly after his marriage. Dr. Cory says:² "It was the second child of the marriage; the first died within a very short period of birth. This child, being apparently healthy, was vaccinated at St. Thomas's Hospital in 1878. It was duly inspected, and was brought again with the eruption, which first appeared on the tenth day after vaccination. This is a very good example of the cases of alleged syphilis after vaccination. It is so tempting for parents to lay the results of their own iniquities upon vaccination, especially when they are encouraged so to do by shameless agitators. To enable us to view the truth of these allegations against vaccination, we will suppose a man to have had syphilis and to play a game of football; he receives a kick on the shin, and in due course a syphilitic node may develop from the bruise. The man would be as entitled to say he acquired his syphilis from playing football as a parent of a child who has had syphilis would be to say that the child acquired its syphilis from vaccination."

Erysipelas may follow vaccination, but there is no proof that the specific organism of this disease is in the vaccine lymph. Erysipelas also frequently follows the scratch of a pin or any slight abrasion, but this is no argument against vaccination but it is an argument for the careful protection of the vaccine vesicle. Urticaria may follow vaccination just the same as that the ingestion of fish and other food may also cause this troublesome eruption. Impetigo contagiosa sometimes appears after vaccination, but as impetigo is an extremely common disease, there is no proof that the vaccination is the cause of this manifestation, as the disease is fully as frequent among children who have not been recently vaccinated as among those who have been recently vaccinated.

Abscesses in the axilla may follow a vaccination, but this condition is extremely rare, and in my experience it has always been due to some carelessness on the part of the individual.

The site of the vaccination may slough, but I have never seen any serious result other than a somewhat tedious healing follow this condition. When this sloughing takes place it is always due either to a diminished vitality of the individual or carelessness in using the arm.

It is doubtful if cutaneous tuberculosis is ever communicable by vaccination, but the abraded surface if brought in contact with the sputum of a tuberculous patient may be infected. This is only another argument in favor of carefully protecting the site of the vaccination. As illustrating how the abraded surface may become

¹ Read before The Massachusetts Medical Society, June 10, 1902.

² Lectures on the Theory and Practice of Vaccination. By Robert Cory, M.A., M.D., Cantab., F.R.C.P., London, p. 65.