

Ward,¹ quoting from Schauinsland, says:

The eggs possess a thick brown shell, and a small lid, which becomes especially distinct at the close of development. They contain a large amount of yolk substance, and do not increase in size. As in all Bothriocephalids the development is carried out in the water and not in the maternal body, so that the inconspicuous egg cell is only rarely to be found in the mass of yolk cells which usually completely conceal it.

Ward⁶ further states that the eggs are from 68 to 70 by 45 microns in size.

Castellani and Chalmers⁷ state that:

The brown eggs are oval, 68 to 71 microns in length, and 45 microns in breadth, with an operculum.

Stephens⁸ gives the following data:

Eggs large, with brownish shells and small lids, 68 to 71 by 45 microns; the ovarian cell, which is already, as a rule, in process of segmentation, is surrounded by numerous large yolk cells.

Faught⁹ says:

The eggs are large with brownish shells and small lids. They measure 0.068 to 0.071 by 0.045 mm.

Todd¹⁰ maintains that:

The ova are characteristic. They measure about 45 to 70 microns, are brown in color, and are filled with small spherules. The shell is thin and has a small hinged lid at one end. As the eggs appear in the feces the lid is not easily seen, but it may be demonstrated by sufficient pressure upon the cover glass to force it open.

Wood¹¹ says:

The eggs measure 45 by 67-71 microns. They are of a brown color and occasionally a small cap or lid can be demonstrated at one end of the egg. The shell is thin and highly refractile. The germ cells are often segmented and surrounded by a number of large yolk cells.

Webster comments thus:

The ova are brownish in color, ellipsoidal in shape, 68 to 71 microns in length and 44 to 45 in transverse diameter, have a thin shell, and a lid which may be opened or closed. The contents of the ova are coarsely granular or mulberry-like.

From these accounts it can be seen that the previous statements concerning the size of the egg in *D. latum* have been misleading on the basis of the present study, and from other indications I am inclined to think that all of our common species of parasites of man and the lower animals will bear investigation along the line of the size of the eggs. It is hoped that others who have material available will undertake such a study on fresh material. The quickest way in which to measure eggs that I know of is to project a scale on a card from a stage micrometer by means of a camera lucida, and to draw the scale, subdividing the spaces to have divisions equal to 5 microns. A similar scale is projected over this scale and at right angles to the first lines. Then the eggs are projected on the scale on the card by the camera lucida and the measurements read off. For the present work a magnification of 700 diameters proved efficient.

6. Ward, H. B.: Cestoda, Reference Handbook of the Medical Sciences, New York, William Wood & Co. 2: 776, 1912.

7. Castellani, A., and Chalmers, J.: A Manual of Tropical Medicine, New York, William Wood & Co., 1914.

8. Stephens, J. W. W.: Platyhelminthes, in Fantham, Stephens and Theobald: The Animal Parasites of Man, New York, William Wood & Co., 1917.

9. Faught, F. A.: Essentials of Laboratory Diagnosis, Ed. 6, Philadelphia, F. A. Davis Company, 1917, p. 152.

10. Todd, J. C.: Clinical Diagnosis, Ed. 2, Philadelphia, W. B. Saunders, 1912, p. 352.

11. Wood, F. C.: Chemical and Microscopical Diagnosis, New York, D. Appleton & Co., 1905, p. 349.

12. Webster, R. W.: Diagnostic Methods, Chemical, Bacteriological and Microscopical, Ed. 5, Philadelphia, P. Blakiston's Son & Co., 1916, p. 144.

CONCLUSIONS

1. There is great variation in the eggs of *Diphyllobothrium latum*.

2. The average length is 63.64 microns, the average transverse diameter 47.33 microns, and the average ratio between transverse diameter and length is 1:1.3775.

3. Because of the great variation in the size of the eggs it is not wise to make a definite diagnosis of the presence of this species entirely from measurements of the eggs, but to consider the morphology of the eggs as well. The cap on one pole and the small thickened nodule at the other clinch the diagnosis. A thorough search for proglottids should be made in the feces in suspected cases.

A METHOD FOR THE PREPARATION OF PROPHYLACTIC AND AUTOGENOUS LIPOVACCINES*

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In prophylactic inoculations with a mixed vaccine against influenza and its complications, it was noted that a small percentage of the persons inoculated developed rather severe reactions.¹ The possible

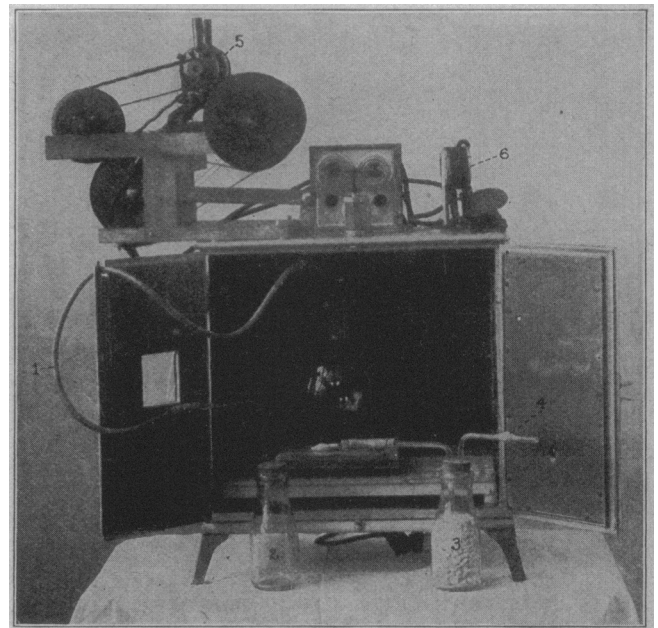


Fig. 1.—Oven and shaking machine.

advantages to be derived by suspending the bacteria in oil, especially when a mixed vaccine is indicated, as first practiced by Le Moignic and Pinoy² and studied on a large scale by Whitmore and his co-workers in the Army Medical School,³ have been pointed

* From the Mayo Foundation.

1. Rosenow, E. C.: Prophylactic Inoculation Against Respiratory Infections During the Present Pandemic of Influenza: Preliminary Report, J. A. M. A. 72: 31-34 (Jan. 4) 1919.

2. Le Moignic and Pinoy: Les vaccins en emulsion dans les corps gras ou lipovaccins, Compt. rend. Soc. de biol. 79: 201-203, 1916.

3. Whitmore, E. R.; Fennel, E. A., and Peterson, W. F.: An Experimental Investigation of Lipovaccines: A Preliminary Note, J. A. M. A., 70: 427-431 (Feb. 16) 1918. Whitmore, E. R., and Fennel, E. A.: An Experimental Investigation of Lipovaccines: An Additional Note, with a Note on Triple Dysentery Lipovaccines, J. A. M. A. 70: 902-904 (March 30) 1918.

out in a preliminary report. Owing to the slow absorption and the fact that bacterial toxins are lipotropic, larger doses may be given with less local and constitutional reaction than when the bacteria are suspended in salt solution. The formation of antibodies should be more marked and the resulting immunity more enduring.

The chief difficulty encountered in the preparation of a lipovaccine arises from the fact that the bacteria must be dried, and all methods used thus far for drying produce a clumping of the bacteria. This makes it necessary to break up the masses formed in the drying process before a homogeneous mixture in oil can be made. The method as worked out at the Army Medical School⁴ consists essentially in drying the collected bacteria in Petri dishes at a relatively low temperature (53 C.), which inevitably causes them to clump in a firm, hard mass. They are then separated by prolonged grinding in bottles containing steel shot. This requires cumbersome and expensive apparatus and involves a number of steps in which contamination is prevented with difficulty. The method is obviously impracticable for the preparation of autogenous vaccines. The possibility that the prolonged grinding may render the bacterial substance more readily absorbable is also an apparent objection.

We have tried various procedures in order to simplify the methods used. In connection with some work in poliomyelitis it was noted that streptococci and pneumococci not only remained gram-positive but also retained specific immunologic characteristics for many months when suspended in 50 per cent. glycerol. The dehydrating power of pure glycerol is well known, and it was thought that this might be an effective agent in drying the bacteria and in preserving their antigenic properties. But glycerol and oil will not mix, even when emulsifying agents are used, and hence this method was found impracticable. Drying the bacteria with absolute alcohol and ether or with acetone and ether, in which the bacteria are less solidly packed than when dried by heat, was thought of, but the possibility of destroying the antigenic properties would not justify the slight advantage gained, since the grinding process would still be necessary. The method of drying the frozen bacteria in vacuo is difficult, requires special apparatus, and does not eliminate the grinding process. The method of drying serums and other liquids at a low temperature in vacuo, as used by Burrows and Cohn,⁵ and by Marmier,⁶ was suggested by Dr. E. C. Kendall. This was found to be effective in getting rid of the water in a closed system and undoubtedly in preserving antigenic properties,

but the grinding process was still found necessary. It occurred to us that if the water were removed by distillation in vacuo from a water-bacterial-oil emulsion, the oil would prevent the clumping of the bacteria and thus make the cumbersome, time-consuming, and otherwise objectionable grinding process unnecessary. With this as the underlying principle, a method has been developed for the preparation of varying quantities of lipovaccines.

METHOD EMPLOYED

The steps in the preparation of large quantities of oil vaccines may thus be subdivided:

1. The method for the preparation of the bacterial paste is identical with that used in the preparation of saline vaccine. The bacterial growth contained in glucose broth is centrifuged out, the continuous feed centrifuge being used.

2. The bacterial paste is removed from the centrifuge bowl under a hood by the use of a spatula, and is transferred to the proper sized, wide-mouth bottle.

Sufficient sterile water is added to give a very dense but homogeneous suspension, and the mixture is thoroughly shaken. One c.c. of water to each liter of broth-culture medium gives about the correct degree of concentration. The bacteria suspended in water are killed by thermal or chemical means. If heat is used, the bottle is immersed in a water bath and kept at a temperature of 60 C. for one-half hour, at the end of which time cultures are made. If a chemical method is to be used, sufficient cresol is added to the water suspension to make it a 2 per cent. cresol solution. The mixture is well shaken. After it has stood for twelve hours, cultures are made. In the case of *Staphylococcus aureus* and of other resistant bacteria, heat and cresol are used in combination. The suspension is heated for one-half hour at 60 C. in a 2 per cent. solution, and then allowed to stand for twelve hours or longer.⁷ When the cultures prove sterile, the dense water-bacterial suspension is transferred to a proper-sized, round-bottom flask. We use the heavy Pyrex flask and have found it very satisfactory. For the preparation of large amounts of vaccine, for instance using the growth from 200 to 300 liters of glucose broth averaging 2 millions of bacteria per cubic centimeter, we ordinarily use a 3-liter flask. For smaller amounts a

two or a one liter flask may be substituted. It is desirable, however, to use one of fairly large capacity because of the increased amount of surface obtained for the subsequent removal of the water in vacuo.

3. For each liter of broth culture, 5 c.c. of sterile cottonseed oil, containing from 5 to 10 per cent. lanolin, are added to the water suspension. To facilitate boiling and to aid in breaking up any bacterial clumps which may form, about 100 gm. of solid glass beads (3 mm. in diameter) or steel shot, three-thirty-seconds inch in diameter,⁸ are added, and the flask is placed in the oven, as shown in Figure 1. Glass beads obviate any oxidase reaction which, in the case of steel shot, may result in a darkening of the suspension. The oven is maintained at a temperature of from 60 to 65 C. The oven and shaking machine, although convenient, are not essential.

7. Sterilization in cresol is more effective at 37 C. than at room or icebox temperatures. Suspensions accidentally contaminated with *Bacillus subtilis* are rendered sterile when incubated at 37 C. for from twenty-four to forty-eight hours, while the control suspensions at the lower temperatures continue to show living bacteria.

8. Hoover Steel Ball Company, Ann Arbor, Mich.: $\frac{3}{32}$ inch diameter, steel burnishing balls.

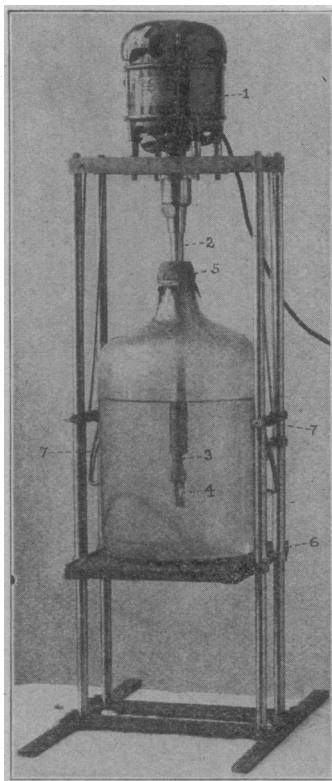


Fig. 2.—Machine for mixing the stock suspension with oil.

4. Fennel, E. A.: Prophylactic Inoculation Against Pneumonia: A Brief History and the Present Status of the Procedure, J. A. M. A. 71: 2115-2120 (Dec. 28) 1918.

5. Burrows, G. H., and Cohn, E. J.: A Quantitative Study of the Evaporation of Blood Serum, J. Biol. Chem. 36: 587-590, 1918.

6. Marmier, L.: Nouvel appareil pour la dessiccation ou la concentration des liquides a basse temperature, Ann. d. l'Inst. Pasteur 32: 145-149, 1918.

Numerous large batches have been evaporated by immersing the flask in a water bath at 65 C., and shaking it by hand at intervals. The flask is connected by flexible pressure tubing (1) to the condensing bottles (2 and 3), the first bottle serving as a condensing reservoir, and the second containing unslaked lime or calcium chloride, which acts as a further drying agent. The parts sterilized include the flask, Tube 1 and Bottle 2. Tube 4 connects with the vacuum pump. The Ge-yk type of pump is used to develop a vacuum of 1 mm. or less of mercury. The rate of shaking is controlled by the small sewing machine motor (5) and the rheostat (6). The length of the stroke is 4 inches. Good agitation is obtained by using eighty strokes per minute. The time necessary to drive off completely all the water depends, of course, on the total volume present. From four to six hours ordinarily suffice for quantities requiring the removal of 150 c.c. or so of water. This length of time is proportionately decreased as smaller volumes of water are used. Until the water is practically all removed, the temperature of the evaporating liquid is from 10 to 15 degrees lower than that of the oven. The distillation requires little or no attention, the apparatus running very smoothly. As the mixture becomes more anhydrous, the viscosity is increased, and the suspension appears as a very thick emulsion when the major portion of the water is removed. As the last portions of water are driven off, the bacterial mass becomes solvated, forming a thick, nearly clear homogeneous suspension. It is important that all of the water shall be removed. The end-point of the distillation may be determined by the almost complete clearing of the mixture and the absence of water condensation in the condensing tube. The vacuum pump is disconnected at the cotton plug in Tube 4. The sterile cotton plug between Bottles 2 and 3 prevents contamination by the in-rushing air. The contents are poured through a fine mesh screen into a stock bottle in order to remove any pieces of cork or clumps of bacteria that may not have been broken up. To prevent any material loss of suspension, the flask may be washed out with small quantities of sterile oil.

4. For use as a vaccine, 1 c.c. of the stock suspension is diluted so as to give a final concentration of 50 billions of bacteria per cubic centimeter. For example, in the procedure just described, 5 c.c. of cottonseed oil are added to the growth from each liter of broth culture, representing 2,000 billion bacteria. Thus the stock suspension contains 400 billions of bacteria per cubic centimeter. This is diluted eight times, giving a concentration of 50 billions of bacteria per cubic centimeter for use as a vaccine. We prefer to base our dosage on bacterial counts rather than on the basis of weight of the bacterial substance. The percentage or error in weighing the dried bacterial substance, containing a variable amount of the precipitate formed in glucose broth as the result of acid produced during bacterial growth, is comparable with the experimental error made in counting bacteria. Moreover, it is difficult to avoid contamination in weighing the dried bacterial substance. If, however, the weight of the dried bacterial substance is desired when large amounts are dealt with, it may readily be obtained by subtracting the weight of the oil used from the total weight of the oil-bacterial suspension as removed from the flask at the end of the distillation.

5. The cottonseed oil and lanolin are sterilized in the autoclave at 15 pounds pressure for thirty minutes, and then

removed while hot and placed in a hot-air oven at 105 C. for an additional thirty minutes, or longer if one is dealing with larger quantities. The flasks should be of the wide-mouth type to facilitate the entrance of steam; they should be filled well to the top and stopped with a cotton plug. This sterilization, together with the removal of the oil from the autoclave while hot, reduces to a minimum the amount of water taken up. Heating in the air oven insures sterilization and removes what water has been taken up by the oil. Contrary to the general opinion with respect to the difficulties encountered in sterilizing oil, we have experienced no difficulty by using this method. Control tests, in which the oil was contaminated with dust containing highly resistant spores, were found sterile in every instance, after using the foregoing method of sterilization. Because of the absence of water, the need for a preservative in lipovaccines is less than in saline vaccines. Various preservatives, such as camphor and chlorbutanol, have been used. In this method the small amount of cresol present in the stock suspension is sufficient to prevent bacterial growth from accidental contamination.

6. In order to insure complete sterility of the final vaccine, rigorous sterility tests are made: (1) of the water suspension of the bacteria after the cresol and heat have been used; (2) of the cottonseed oil containing lanolin which is added to the water suspension; (3) of the stock suspension after distilling off the water, and (4) of the final oil suspension to be used as a vaccine. The cultures are made on blood agar in tall tubes of glucose bran broth and litmus milk. In addition the final product is injected into animals to insure sterility.

In order to thoroughly mix large quantities of the stock suspension with the oil for final use, the machine constructed for us by Mr. Little, is found convenient (Fig. 2). It consists of a vertical, one-eighth horse-power motor (Fig. 2, 1) fitted with a removable sleeve (2) which contains bearings for the shaft (3), to which are fastened two propeller blades (4). These are thrown out horizontally as the shaft revolves at a rapid rate (1,700 revolutions per minute). The sleeve and shaft slip off together; these are sterilized and introduced through the small hole in the rubber dam (5). The support (6) is adjustable and is held securely in place by the hooks (7). The bottle, which has a capacity of 5 gallons, is filled three-fourths full. Smaller bottles may be used as required. The revolving blades are placed so as to produce a vigorous downward and outward current; hence the agitation is violent and soon results in an even mixture.

COMMENT

This method has given perfectly even, homogeneous suspensions with various species of bacteria. Large quantities of the mixed vaccine used for prophylactic inoculation against influenza, containing type pneumococci, Group IV pneumococci, green-producing streptococci, hemolytic streptococci and staphylococci, have been prepared by mixing in the centrifugal bowl the bacteria grown separately, as well as by mixing the dried oil suspensions of the different strains. In addition, excellent lipovaccines have been made of typhoid-paratyphoid and dysentery bacilli, of influenza bacilli, colon bacilli, *Streptococcus viridans* from endocarditis, gonococci and meningococci. The antigenic and toxic properties, especially in varying the doses



Fig. 3.—Flasks used for the vacuum distillation of water from water bacterial-oil emulsion.

of the mixed vaccine for influenza, will be reported in detail later. It is sufficient to state here that as high as 90 billions of bacteria have been given to a few persons, with only slight constitutional and local reaction. A dose of 0.5 c.c. containing 25 billions of the dried bacteria in the oil given more than 500 persons during a recrudescence of influenza rarely produced more than a slight reaction. But after the use of this vaccine, as after the use of the saline vaccine, an occasional person reacted more severely and a sterile abscess formed. Antibody production—agglutinins—has been found pronounced following the injections of such dosage. It is therefore evident that the somewhat prolonged heating in the oil in vacuo when large quantities are prepared does not destroy the antigenic properties.

It is imperative that there shall be no living bacteria in the water suspension at the time the oil is added. Early in the work it was thought that heating during the distillation in vacuo would serve the double purpose of killing the bacteria and driving off the water. This was found not to be so. Many of the suspensions showed living streptococci and other bacteria after prolonged heating at temperatures from 60 to 75 C. Temperatures as high as 100 C. for a period of two hours failed to kill after the water had been removed.⁹ It is obvious that the mixture must be sterile at the time the oil is added. The heat used in the distillation does not alter materially the antigenic properties of the bacteria since it is not even sufficient to kill them. On the basis of this fact, moreover, there is good reason to believe that heating the water-bacterial-oil emulsion to the boiling point of water under atmospheric pressure will not destroy the antigenic properties of the bacteria. Should this be found to be the case the method might be simplified still further.

It is desirable in order to decrease the toxicity of the vaccine that the distillation shall be continued until the suspension has become cleared. This is well indicated in the following experiment: Two parallel series of persons—six in each series—were inoculated with equivalent doses of the mixed vaccine as used for prophylactic inoculation against influenza. One series received the incompletely dried, turbid suspension; the other the more completely dried and cleared suspension. Two persons in each series received each, respectively, 25 billions, 50 billions and 75 billions of bacteria subcutaneously. The results showed that the incompletely dried suspension was decidedly more toxic, producing more reaction, both constitutionally and locally, especially locally, than the completely dried suspension. There was no fever nor other evidence of constitutional reaction in any who received the latter. This decreased toxicity is apparently due to a detoxicating action of the oil or lanolin as they permeate the bacterial substance or to a delayed absorption or both.

The clearing that occurs as the oil permeates the dried bacteria is so striking as to suggest actual solution; but this is not what takes place, since the bacteria, on making a watery suspension from the oil, stain normally and are of sharp outline.

9. This observation suggested at once the possibility that bacteria might live in latency for a long time when dried in vacuo in oil. Strains of many species of bacteria have been filed away and are being studied as to viability and antigenic properties. Both viability and specific immunologic properties of some have been retained for months. Also the present method for immunization against rabies might be greatly simplified if the dried virus (rabbit cord) were suspended in oil. The further results will be reported later.

It has been found that the oil will not permeate bacteria dried in air in the usual way as completely as those dried in vacuo in the presence of oil. The toxicity of the former should, according to the foregoing experiment, be proportionately greater.

It may be suggested that desensitization against pollen or other protein substances may be greatly enhanced by the use of an oil instead of a saline suspension.

PREPARATION OF AUTOGENOUS LIPOVACCINES

The common 6-ounce nursing bottle shown in Figure 3 has been found useful for the preparation of autogenous lipovaccines. It serves admirably as a culture flask, centrifuge tube and vacuum flask. The bacteria are grown in tall columns of glucose broth (150 c.c. per bottle) for twenty-four hours, centrifugalized, the supernatant clear broth decanted, and the sediment suspended in 10 c.c. of a 1.5 per cent. solution of purified cresol in water or salt solution. This is thoroughly mixed and placed at 37 C. for from two to fifteen hours, when cultures are made. Streptococci and pneumococci are usually killed in from two to twenty-four hours. As soon as the suspension is found to be sterile it is centrifugalized; the supernatant fluid is decanted, and 6 c.c. of cottonseed oil containing 2 per cent. anhydrous lanolin and a number of sterile glass beads or steel shot are added. The mixture is emulsified by being shaken for a short time. The small amount of water from this water-bacterial-oil suspension is now removed by applying the vacuum and immersing the bottom of the bottle in water heated to 60 C. By means of vigorous shaking at intervals the removal of the water is hastened. The vacuum and the heat are applied until bubbling ceases and the mixture becomes clear. The time required depends on the completeness of the vacuum and the amount of water to be removed, but the clearing usually takes place in from twenty minutes to one hour. The ordinary bacteriologic test tube as shown in Figure 3 may be used for the preparation of still smaller amounts, but for most purposes the bottle is to be preferred. If larger amounts of bacteria are required, the water or salt solution suspensions of a number of bottles are placed in one, and a correspondingly larger amount of oil is added. By the use of Y tubes the water from a series of suspensions may be removed at one time.

If, for example, bacteria such as influenza bacilli, gonococci, and meningococci, which grow better on solid mediums, are to be used, the growth should be scraped together and washed off with salt solution so that the final suspension is roughly equivalent to that containing the bacteria from the broth culture. Sterilization and the further steps are carried out as above. In the case of the more resistant bacteria, such as staphylococci and paratyphoid bacilli, heating the cresolized suspension to 60 C. for one hour hastens the sterilization. The final bacterial content of the lipovaccine is calculated on the basis of counts made of the bacteria suspended in salt solution or on the basis of the total number of bacteria per cubic centimeter of broth culture. In the broth used in our laboratories, the amount of growth of pneumococci and streptococci is usually about 2 billions and the vaccine is made to contain approximately 50 billions of these organisms per cubic centimeter. The number of bacteria in the oil may be increased ten or twenty fold without inter-

fering materially with the evaporation of the water or with the even distribution of the bacteria.

The value of autogenous lipovaccines in the treatment of various diseases is now being studied. Striking cures have been noted following the administration of a single large dose of staphylococci (80 billions) in severe recurring furunculosis. Benefit has followed the administration of autogenous pneumococcus and staphylococcus lipovaccines in infections of the maxillary sinus. Judging by the slight constitutional reactions, even when huge doses are given, and the improvement in the few cases studied, it would seem that much good might come from the use of autogenous lipovaccines, especially in the treatment of chronic or recurring infections, when a prolonged immunization is indicated. Marked benefit, it would seem, might come from the use of autogenous lipovaccines in diseases due to focal infection, particularly if foci are removed and the vaccine is made to contain the specific micro-organisms as isolated from the focus.

THE NEWER METHODS OF CESAREAN SECTION

REPORT OF FORTY CASES *

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The classic cesarean section has come to be one of the safest laparotomies, and at the same time one widely practiced. There is no question that it is too widely practiced, the trust in its general safety being great. This idea in regard to its general safety is the result of the publication by obstetric specialists of series of from fifty to 100 cases without mortality. I myself have had more than 100 successive classic cesarean sections without maternal death ascribable to the operation. Even the people have become imbued with the notion that cesarean section is entirely safe. Indeed, one woman was sent to me by a physician who told her the abdominal delivery was *the* method of childbirth of the future.

MORTALITY FROM CESAREAN SECTION

Accoucheurs of experience know that cesarean section is not so safe. They know that their good results are due to the careful selection of the patients submitted to the operation. They have observed numerous fatalities when proper strictness was not observed in deciding on the abdominal delivery. F. S. Newell said he knows that in several towns around Boston, the mortality (unpublished) from cesarean section has been frightful. He reports eight deaths in 100 cases at the Boston Lying-In Hospital up to 1909. Amand Routh, in 1910, found a general mortality for England of from 2.2 to 34 per cent., depending on the condition of the mother at the time of the operation. Cragin had 143 clean nontoxic cases with three deaths. Williams believes the general mortality will be 10 per cent., and only in the most ideal surroundings and, at the beginning of labor, will it be from 1 to 2 per cent.

In Chicago, deaths due to cesarean section not infrequently occur but are not put on record, and recently the newspapers of a certain county of the state pub-

lished a successful cesarean section as a wonderful achievement, the woman being the first to survive the operation in the county.

There is an unavoidable mortality to cesarean section. It increases: First, with the length of labor; one might say about 1 per cent. every two hours; second, with the number of vaginal examinations made, or operations attempted; third, with the rupture of the membranes; fourth, with the lack of skill of the operator. Furthermore, there are certain women who carry infection in the vagina—harmless there, but fatal if brought on to the peritoneum. There is no way of discovering it beforehand. Leopold of Dresden found gonorrhea in some of these cases.

MORBIDITY OF THE CLASSIC CESAREAN SECTION

In addition to the mortality, the classic cesarean section has a distinct morbidity. Just as the mortality has been gradually reduced by proper selection of the cases, by operating early, by refinement of operating-room technic, etc., so has the morbidity been reduced—but not in like proportion. A large proportion suffer from peritoneal shock. In fully 20 per cent. of the cases there is fever after operation. Uterine abscess occasionally follows, partial paralytic ileus and gastric dilatation not seldom occur, adhesions of omentum or intestine to the uterine or abdominal scar are the rule, and the danger of rupture of the uterine line of suture in subsequent labor is still a real one. The five main objections to the classic cesarean section are: the inherent mortality, the frequency of abdominal complications, adhesions, rupture of the scar in subsequent labor, and the necessity to restrict the operation to clean cases.

In infected, or possibly infected cases of obstructed labor, since pubiotomy is too dangerous, craniotomy is the only alternative; and it is to reduce the necessity of this horrible operation that the newer methods of cesarean section have been developed.

Since the objections enumerated always beset the classic cesarean section, and since the greatest dangers came from the fact that the peritoneum was opened, the old accoucheurs sought to avoid this necessity and tried to extract the child from beneath the peritoneum. The first suggestion came from Joerg in 1809, and Ritgen performed the operation in 1821. Physick of Philadelphia, in 1824, recommended this method to Dewees of Philadelphia, but I could not find that Dewees had performed it. Joerg had suggested that the incision be made in the flank, and that the peritoneum be dissected upward, in the manner preparatory to ligation of the internal iliac artery, the child then being extracted from the parturient canal. In 1870, T. Gaillard Thomas revived the operation which had been named "gastro-elytrotomy" by Baudelocque. Very few of these cases were successful, as we can readily understand. It was because of the lack of asepsis, and infection killed nearly all of the women.

ATTEMPTS TO IMPROVE THE CLASSIC CESAREAN SECTION

Attempts to improve the classic cesarean section, to make it adaptable to the neglected cases, failed until 1906, in which year Frank, of Bonn, disinterred the old extraperitoneal methods. He opened the abdomen just above the pubis, united the peritoneum of the uterus to the peritoneum of the abdominal wall, thus shutting off the general peritoneal cavity, and delivered the child through the almond-shaped space provided.

* Read before the Section on Obstetrics, Gynecology and Abdominal Surgery at the Seventieth Annual Session of the American Medical Association, Atlantic City, June, 1919.