systemic depression, decided me in favor of the enucleation. The case occurred in private practice and was seen in consultation with Dr. W. F. Norris, who concurred in my opinion. Post-operative senile dementia followed the operation, the mind becoming entirely clear with returning strength; no local complication followed.

The second case was one of inflamed scleral staphyloma, with beginning sympathetic irritation. I had intended in this instance to do a Mules operation, but upon dissecting the conjunctiva from the globe found such pronounced scleral distension and attenuation that the eyeball, when freed from the conjunctival attachment, immediately protruded so far forward that I was inclined to fear a possible growth in the posterior portion of the orbit. This did not prove to be true. This excessive protrusion with such striking distension and attenuation constituted, in my judgment, sufficient reason for not risking the introduction of an artificial vitreous.

I am still using catgut sutures for stitching the sclera in the Mules operation and silk sutures for the conjunctiva.

Dr. J. L. THOMPSON of Indianapolis—I wish to speak of some of the conclusions and of the comparison of the two operations. Some of the gentlemen have spoken of the fixed condition of the eyeball and of patients shunning society after enucleation. Have many of you found fixation of the eyeball after enucleation, unless there was atrophy or in burns of the eye? And the question in such cases is whether you would accomplish much more by this operation. I must have seen several hundred cases of enucleation and I have not noticed this staring appearance; I should not expect to see it unless the operation were done with a pair of sheep-shears or by some one who knew nothing about it. I think after you had as many cases of this operation as we have of the older one, you will find a great many cases of failure.

Dr. J. C. DUNLAVY of Sioux City, Iowa—The fitting of an artificial eye is one of two objections to this procedure. The implantation of a glass ball places the thin tissue continually between two glass surfaces. It appears to me that the tissue can only last a certain length of time and sooner or later will be destroyed. The staring eyes referred to after enucleation is to me one of the greatest horrors. In late years I never enucleate an eye unless absolutely compelled to, to save a fellow eye; if I can not do anything else I do the ordinary evisceration and find the small stump left is preferable to removal of the entire globe. I have never seen any reason for this staring except that the artificial eye does not fit. Rubber balls instead of glass ones appears to me to be impracticable, for I should consider that they in time would be destroyed.

Dr. S. C. AYRES of Cincinnati—I would like to mention an unique experience in the use of these balls. I was in London and bought a few of them when they first came out. A short time after, Dr. Sattler had occasion to use one of them. The operation was done properly, but two or three days later irritation set up and the stitches had to be taken out and the ball removed. We found a little pus in the glass ball; it had been a defective one with a little opening in it and had excited the trouble. It only serves to show what the possibility might be in the use of a glass ball, and I should think a silver ball might be better.

Dr. A. E. PRINCE of Springfield, Ill.—I have been using the glass balls for about twelve years and have not had very great success with them. In one case out of a series of six there was a splendid result; the other five failed. Now the silver ball has been spoken of and there is a point in general surgery that must be universally known, and that is that silver when in contact with granulating tissue becomes coated with lactate of silver, which is demonstrated to be a good antiseptic. Now if we use the silver ball and lactate of silver is formed, we have generated an antiseptic that may prevent failure in such cases as Dr. Ayres suggests, whereas in case of the glass ball the result would be disastrous.

Dr. GEORGE FRIEBIS of Philadelphia—I have had but little experience with the Mules operation. I had more with enucleation, but the Mules operation in all suitable cases will undoubtedly give far better results so far as cosmetic effects are concerned, and as has been emphasized, that is one of the principal points to be considered. The cases must be properly selected, but in many cases the Mules operation is one of superiority over enucleation because the motility of the eyeball is almost equal to that of the sound eye. I have seen several cases of enucleated eyeballs that presented the staring appearance undoubtedly. One that I performed some time ago, and I think I performed the operation with a fair degree of skill, presented considerable reduction or retraction of the ball, and that in itself is a cause in many instances of that staring condition that I detect after enucleation and which is absent after the Mules operation.

Dr. L. W. Fox of Philadelphia—I wish to call more attention to the implantation of the glass ball than to the Mules operation, which will take care of itself. The gentlemen who saw the operation of implantation yesterday saw that it would have been impossible to adjust an artificial eye, and it is in such cases that implantation is of the greatest value. It produces a bulging out of the stump upon which an artificial eye can operate. My first three cases were cases of a similar character, performed in 1895, and they have since been wearing artificial eyes with good adjustment and good movement. It is not as good as in the Mules operation, but better than complete enucleation. The case on which I operated yesterday was shown to six or eight of the gentlemen today, and the reaction was very slight; I am sure they were all surprised. Had not the gentlemen been there today I should have kept the bandage on for two or three days, as I find that a great improvement; I called attention to that point in my last paper. As regards the glass ball carrying infected or septic material into the eye, all the glass balls I have been using were sterilized in boiling water and if they are defective the water finds entrance into them and I throw them away.

Dr. ALBERT PICK of Hyannis, Mass.—In answer to Dr. Dunlavy's objections I would say that I simply tried this experiment for the sake of finding an elastic, unbreakable, aseptic substitute for Mules' glass ball, and that the rubber, hard or soft, will not degenerate as easily as the Doctor thinks.

BACTERIA IN THE NORMAL CONJUNCTIVA AND THE EFFECT UPON THEM OF ASEPTIC AND ANTISEPTIC IRRIGATIONS.

Presented to the Section on Ophthalmology at the Forty-eighth Annual Meeting of the American Medical Association held at Philadelphia, Pa., June 1-4, 1897.

BY ROBERT L. RANDOLPH, M.D.

BALTIMORE, MD.

The works of Leber, Sattler, Gifford and others on the bacteria of the conjunctiva are practically in accord in the opinion that the conjunctiva always contains bacteria. I recently made a series of experiments upon 100 individuals. These 100 persons comprised patients (not eye patients) in the dispensary, nurses, medical students and others. The inoculations were on nutrient agar, and usually smear cultures were made. A platinum loop was sterilized by passing it through a flame, and it was rubbed over the lower part of the conjunctival sac. The patient was then made to look down and the loop was carried well up into the upper part of the sac, and finally rubbed gently over portions of the bulbar conjunctiva. It is hardly practicable to bring the loop into contact with every part of the conjunctiva, and I doubt whether the platinum loop ever touched more than half the conjunctival surface, and yet out of the 100 cases there were only thirteen sterile tubes. If then inoculations from a limited area of the conjunctiva show the presence of the bacteria in eighty-seven out of 100 cases, it is more than probable that inoculations from the whole conjunctiva would show the latter to invariably contain bacteria. One must be careful in this class of experiments to avoid touching the eyelashes or the free border of the lids, as contamination will certainly result. In eighty-five out of the eighty-seven cases where bacteria were found, the latter resembled each other morphologically. No effort was made to determine the properties of this organism, and nothing can be said of it further than that it looked like one of the pyogenic cocci.

In surgery two methods are employed to sterilize the field of operation: The aseptic method, by which bacteria are removed by mechanical means (as for instance, the irrigation of a point with water which

has been sterilized by heat), and the antiseptic method consisting in the employment of chemicals which have the effect of either destroying bacteria or of interfering with their growth. Both methods were tested in two series of fifty experiments each. First the aseptic method: Inoculations were made from individuals with normal conjunctivæ. After this the conjunctivæ were irrigated three times (with an interval of five minutes between each irrigation) with water which had been sterilized by boiling, and inoculations were made from them again into agar. There was a growth in forty of the tubes representing inoculations before the employment of the aseptic irrigation; the other ten tubes were sterile, and hence are not counted in the results. After the aseptic irrigations there was a growth in thirty-two tubes, that is to say the apparent effect of the aseptic method was to produce sterility of the conjunctiva in eight cases out of forty. It is evident from this that we can not rely upon aseptic irrigations of the conjunctiva to produce sterility of this membrane. Another series of fifty experiments were then made. Inoculations were made to see if the conjunctivæ contained bacteria, and immediately afterward these conjunctivæ were flooded with a sublimate solution 1 to 5,000. Five minutes later inoculations were made from them again. Before the use of the sublimate forty-two tubes presented growth and eight were sterile. The eight are excluded. In the forty-two cases where there was a growth before the instillation of the sublimate there were nine sterile tubes after the use of this solution. The same staphylococcus which was so constantly found in the first series, was also found in the second and third series, and in the last twenty-five cases this organism was subjected to this test. The end of a platinum loop, after being thoroughly rubbed over the growth, was immersed in a solution of sublimate 1 to 5,000, and allowed to remain there for five minutes. The loop was then withdrawn and plunged into agar, and in every case there was a luxuriant growth, a result which showed that the chemical had apparently no effect on the vitality of the organisms.

Both aseptic and antiseptic methods then in my hands led to practically the same results, for by neither method was sterility of the conjunctiva obtained. I have frequently observed that persons complain of a biting sensation in the eye after an instillation of sublimate solution, and in my experiments hyperemia of the conjunctiva was produced a number of times, so I am inclined to think, in spite of what Franke has said on this point, that such solutions are more or less irritating in their effect on the conjunctiva. All that can be said of such a solution is that it may deprive the conjunctival bacteria of some of their virulence, in other words render them less effective, and then again it may actually kill some of the more superficially situated bacteria. It is more than probable that the conjunctival bacteria are so firmly attached or imbedded in the conjunctiva as to be beyond the reach of either the aseptic or of the antiseptic method as practiced by ophthalmologists, and nothing but the most vigorous scrubbing would produce asepsis.

The experiments reported here show that in so far as the conjunctiva is concerned, little reliance can be placed on the usual methods employed by ophthalmologists for obtaining asepsis.

Conclusions.—The normal conjunctiva always contains bacteria. It is probable that the bacteria found in this locality are usually of only slight, if any, path-

ogenic character. It should be remembered though, that bacteria ordinarily non-pathogenic may become harmful under certain conditions, that is if the tissues are bruised by the instruments or irritated by chemicals. Neither the irrigation with sterilized water nor the instillation of a sublimate solution (1 to 5,000) produces sterility of the conjunctiva, and inasmuch as both measures are futile and possibly harmful they may just as well be abandoned. These methods of sterilizing the conjunctiva are the ones usually employed by ophthalmologists, and hence the choice of them for testing this question. It goes without saying that a method which would destroy the bacteria of the conjunctiva without at the same time impairing the integrity of this membrane would be a great advantage. In operating upon the normal conjunctiva as in cataract operations, the surgeon in the present state of our disinfecting armamentarium would do well to consider the subject of antiseptic and asepsis chiefly if not solely in connection with his hands and instruments, and of course the cocain and atropin.

DISCUSSION.

Dr. HAROLD GIFFORD of Omaha—With these conclusions of Dr. Randolph I agree almost entirely. I have made this thing something of a study and I have found it practically impossible to sterilize the sac, as I believe everybody has found. That in some cases the normal conjunctiva has been found sterile, I think we can attribute to the method used in trying to find out whether bacteria are there or not. Now if you consider the effect of trying to get bacteria by wiping a wire loop around the conjunctiva you will see that you may get some few perhaps at one point and then wipe them off at another, and so perhaps get none. To me, the best method of testing this subject appears to be that of Bardelli, who after separating the lids widely with a speculum filled the sac with soft gelatin. Leaving this in a few minutes and then withdrawing by a pipette he made it into a plate, and by this means the conjunctiva has never been found sterile.

Now as to the reason why we can not sterilize the conjunctival sac. As Dr. Randolph has said, the skin has been shown to be impossible of complete sterilization without complete removal of the epithelium, and even that may fail. The conjunctiva is so smooth a membrane you would expect to sterilize it by wiping it well, but even if you remove all on the surface the germs from the crypts will come out and multiply and you have the same condition as before. Even if you could temporarily sterilize it you could not rely on the condition existing more than an hour or so after closing the lids and applying the bandage. Moreover, in attempting to get this much-desired asepsis, we run the risk of doing more harm than good, for in using these agents you may irritate the tissues so that the bacteria that are left will proceed upon the favorable conditions left, denuded epithelium and increased blood supply, and in twenty-four hours you have a worse condition than if nothing had been done.

Just one point I would like to insist upon where I differ with Dr. Randolph, namely, that we should pay all attention to the asepsis of the hands and instruments. We do not rub the eyes with our hands, but the instruments are of extreme importance. As we are not certain of getting all the germs away from the eye before passing any instruments into the eye we should wipe off the eye with a sterile swab. I wipe off the immediate surface with a sterile swab the instant before inserting the instrument.

Dr. J. E. WEEKS of New York—I think it would be unfortunate if the impression should go out that we must forego all attempts to render the conjunctival sac as clear of bacteria as possible. It is well known that the majority of bacteria found in the sac are innocuous. I have done considerable work in that line myself, and from the normal conjunctiva I have isolated ten or twelve distinct varieties of micro-organisms, of which only two or three were pathogenic. There is another thing we should bear in mind and that is that the bacteria there present may be pathogenic and yet create no disturbance unless they are present in large quantities. We can so lessen the number of micro-organisms present that they will be relatively harmless. We find some secretions from the lachrymal sac that escapes the casual observation, and if they are thoroughly washed out we have no trouble from them, but if no attempt is made to cleanse the sac we shall have trouble. I

think the attempt to cleanse the conjunctival sac has done much to increase the number of successes in operation upon the eye. To advocate the cessation of these attempts would return us to the bad results given before antiseptics was instituted. It has been my practice ever since my studies began to use an antiseptic solution; I have used the bichlorid in strength of 1 to 5000, frequently boric acid solution, and I have yet to regret the use of those solutions, and have congratulated myself on its use in many cases where I am quite sure I should have had trouble if I had not used it.

The experiments Dr. Randolph has described are very excellent in many respects. In the use of the loop to expose the micro-organisms to a 1 to 5000 bichlorid solution for five minutes, he certainly introduced a mass of bacteria that could not be effectually reached by the solution in that space of time, and there are few who would claim that the death of these organisms would be brought about by such exposure.

Dr. A. R. BAKER of Cleveland—I can not contribute to the pathologic study of the subject, but I have thought for many years that the bacteria present could not be washed away, and that probably if they were we should do harm in the efforts. I have my patients come into the hospital the day before the operation, thoroughly cleanse the eyelashes and lids, remove all loose lashes, scrape the lids thoroughly, as I would in preparing for operation in any other part of the body, apply a sterilized bandage and leave it on over night, and if the lids show any secretion in the morning I leave it without operation until I can bandage the lids over night and have no secretion, and so I exclude the possibility of having any large number of micro-organisms present.

Dr. MYLES STANDISH of Boston—I agree with Dr. Randolph as to the necessity of cleansing the lids, but we must remember one other source of infection, however, and that is the tear-sac. The question whether we have a tear-sac distended is one of the greatest importance, and the first thing to discover is whether we have a prolific source of irritation in that region.

Dr. F. C. HOTZ of Chicago—I only wish to say a few words in regard to cleaning the retrotarsal fold preparatory to operations. It is difficult to reach all parts of the upper folds. I have seen it attempted by passing the nasal syringe or the eye dropper under the lid and expecting to flush the folds sufficient to cleanse them as well as we can, and I think a better method is to turn the lid, and fixing it with the thumb of one hand, pass the lower lid over the eyeball and press it back into the orbit. A slight pressure fully exposes the fold and you can wash it very successfully.

Dr. LUCIEN HOWE of Buffalo—The remark I would make is *apropos* to Dr. Hotz's remarks, that the great difficulty is in reaching the retrotarsal fold. I have followed an excellent device for some time, the credit for which belongs to Landolt, which consists of a glass button with a tube entering near the center. This button is put under the upper lid and by holding in this way [demonstrating] the fold is brought out and can be flushed thoroughly. He recommended it first for flushing the eye in ophthalmia neonatorum, but it is excellent for general use.

Dr. ROBERT L. RANDOLPH of Baltimore—The point which Dr. Weeks has made is a good one. It is quite possible that the entire mass of organisms was not penetrated by the sublimate, but I should have added that this identical organism has been subjected to the usual tests at the hands of others and found to retain its vitality after immersion in sublimate solutions, so that the facts are as I have stated them, namely, that the organism which is to be found so often in the normal conjunctiva is proof against the germicidal action of sublimate in the strength employed by ophthalmologists.

THE BEST METHODS OF STERILIZING OPHTHALMIC INSTRUMENTS AND SOLUTIONS OF MYOTICS AND MYDRIATICS.

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BY E. A. DE SCHWEINITZ, M.D.

DIRECTOR BIOCHEMIC LABORATORY, DEPARTMENT OF AGRICULTURE; DEAN AND PROFESSOR OF CHEMISTRY, COLUMBIAN MEDICAL COLLEGE, WASHINGTON, D. C.

That process of sterilization is of course the most useful which gives the best results and can be most quickly carried out, as boiling, where it is convenient,

has been the means par excellence long recognized for destroying bacteria. Specially devised droppers, as Stroschein's and Llewellyn's bottles, in which the solutions of mydriatic or myotic can be boiled before use, are satisfactory, but unless a cap is provided for the exit tube, or the tube itself has a bend that serves as a trap and keeps the solution in the bottle free from dust, there is always danger of contamination of the solution upon repeated handling. Even if the bottle is provided with such a trap, the solution which collects in it should be removed each time before use by gently flaming the tip, or by the use of disinfectants. The mere forcing of more solution through the unsterile tube will suffice to contaminate the contents of the flask.

I have had a flask made which with very little trouble appears to obviate this danger. After use the tip of the bottle may be dipped in a 1 to 1,000 trikresol, or 1 to 5,000 formalin solution (either of which could be conveniently kept in a low, wide-mouthed bottle) when sufficient liquid will be drawn in to fill the bend and serve to seal the flask and prevent the entrance of germs from the air. When the flask is to be used the first few drops of liquid may be wasted and the tip dipped again in the 1 to 1,000 solution to destroy any germs adhering to the outside. These flasks may serve for solutions sterilized by heat or chemicals. Methods of chemic sterilization, or a combination of chemic sterilization and boiling are better than boiling alone. As has been pointed out by Franke,² G. de Schweinitz and the writer,³ and others, the use of boric acid for the purpose of sterilization is unsatisfactory, as its germicidal properties are much less than were originally supposed. The objection to mercuric salts lies in the strength as well as the poisonous properties of the solution which should be used to insure complete sterilization.

Credé⁴ has pointed out the value of the acetate and lactate of silver as germicides, and the idea suggested itself that these salts might be useful in sterilizing collyria if they would not be too easily decomposed, but the ready precipitation of the metallic silver made them useless for this purpose. The ever faithful carbolic acid has been largely replaced by trikresol, the latter being less poisonous and more efficacious in weaker solutions, and as the writer⁵ pointed out in 1894, collyria made up with a solution of 1 to 1,000 remained thoroughly sterile under the most adverse conditions, and were not irritating to the eye. Upon writing to five prominent ophthalmologists, I learned that only one had used trikresol in place of carbolic acid, but he reported very satisfactory results. It so happened that I had left the solutions used in my original experiments three years ago, in a closet by my working table, and recently I tested them to see if they had become contaminated. One of the bottles