procedure of refilling with the assistant holding the retroauricular region was performed after two days and after that only once a week for a period of three weeks.

Result.—At the end of this time the paste was removed, and I found the cavity entirely epidermized. The usual large canal, especially in the region of the aditus ad antrum and attic, was wanting, and in its stead was a formation, hard in consistency and possibly of bony character.

In other cases, after similar treatment, this formation was not present to the same degree, but the canal is always smaller in the aditus region than that obtained by means of packing. I am not particularly sorry for that, as the large canal only harbors epithelial masses. This case was an example of the most rapid epidermization I have ever seen.

CASE 9.—Patient.—Mr. S., referred by Dr. D. for acute mastoid operation, similar to case of Mrs. O'B.

Operation and Treatment.—After thorough exenteration of the mastoid cells, the cavity was filled with gauze and drained for three days, after which the gauze was removed and bismuth paste 3 substituted. Injections were repeated every three days for two weeks; then once a week for three weeks.

Result.—The cavity was healed. This case is an example of more rapid healing, fewer granulations, and less defect than obtained by the usual method of gauze drain.

CASE 10.—Patient.—Mr. B., aged 49, as long as he could remember, had had a discharge of pus from his left nostril, associated with headaches, especially over the eyes, and difficult breathing through left nostril.

Examination.—This showed marked tenderness over left frontal sinus in contradistinction to the right sinus. Transillumination was positive on the left side. Radiogram showed involvement of left frontal, ethmoidal and antral regions. Examination of the nose showed multiple myxomatous polypi and mucopurulent secretion on left side, the right being free.

Operation and Treatment.—The first steps were removal of the multiple polypi, middle turbinectomy, ethmoid curettement, and puncture of the antrum and inferior meatus, and immediate injection with bismuth paste 2. The entire nasal cavity was daily filled with the same substance. The patient much improved as to his frontal headaches, but after six weeks of this sort of treatment he still had a purulent discharge from the frontal duct. Passage of the canula into the frontal sinus was impossible. A second operation was therefore performed. After local periosteal anesthesia over the left eyebrow a small incision was made down through the periosteum into the bone, and a small opening was trephined, into which the tip of a metal syringe was introduced and the cavity filled to distention with paste 2. By nasal examination observed during injection, the escape of the paste from the nasofrontal duct. This region was firmly packed, the sinus (frontal) injected through the external opening until it returned along the tip. The small incision was closed with one suture.

Result.—The patient made an uneventful recovery and I trust the trouble will not return.

CASE 11.—Patient.—Mr. P., aged 47, for about one year had been suffering with headaches over the eyes. These pains increased in severity, and since the last two months he had attacks about once a week that were almost unbearable and required the physician's aid, who has given him a hypodermic injection of morphin. The pains were worse in the morning.

Examination.—The eyes were practically negative. In the nose there was no evidence of pus, but a polypoid mass was seen under the anterior end of the middle turbinated body, and this body was crowded towards the septum, especially on the left side. Transillumination and radiograms were positive of frontal sinus involvement of the left side.

Operation and Treatment.—The first step was removal of middle turbinated body and ethmoid curettement. The result was only partial relief from head pains. After waiting for several weeks, I decided to do an external frontal sinus operation, according to my method of osteoplastic flap. I found the left frontal sinus filled with pus and edematous lining membrane. The right was free. The result as to the headaches was good; the patient was free from them, but there developed a retention and discharge at the external canthus end of the incision. After a brief period of time I decided to re-enter the

frontal sinus from without and under local anesthesia. I removed the bone flap and completed a modified Killian, not removing the orbital roof or floor of frontal sinus, or performing the usual exenteration of the anterior ethmoidal cells through the nasal process of the superior maxilla. Thoroughly curetting the membranes of the frontals, I filled with bismuth paste 4 and closed completely.

Postoperative History.—The patient made an uneventful recovery; the wound healed within a week, with very little deformity. A subsequent x-ray picture seven weeks later shows the bismuth paste still within the cavity. The nose is in good condition, and healing much shorter than when the cavity is allowed to granulate without the introduction of the paste.

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NOTE.—Because of lack of space, the article is here abbreviated by the omission of some case reports. The complete article appears in the author's reprints.

PROPHYLAXIS AGAINST INFECTIOUS DISEASES FROM THE STANDPOINT OF THE PRACTITIONER*

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Investigations of recent years regarding the transmission of infectious diseases have contributed many facts of profound importance. In their bearing on the point of view that should be adopted by the practitioner they have been especially important, because they have made clearer his powers and his responsibilities. They have, indeed, made more definite and certain the fact, which was always logically evident, that practitioners as a body have more power, and therefore more responsibility, in controlling and ultimately destroying these diseases than have any other persons, even including hygienists and health officers. They have this great power chiefly because, owing to their peculiarly close relations with their patients, they are in a better position than are any other persons to educate the laity into a proper comprehension of what lay relations to infectious diseases should be; and because also practitioners are in command, and in almost all instances they alone are in command, at the critical point, that is, in dealing with the sick themselves when the infection has not yet taken its first step beyond the patient.

NECESSITY OF EDUCATING THE PUBLIC

As to the first of these things that I have mentioned, the power exerted by widely disseminated knowledge is at present so clearly recognized in connection with medical matters, as in connection with others, that it requires no demonstration. One need do no more than refer to the changes that have occurred in connection with tuberculosis. A few years ago the most generally dreaded of all diseases and one of the most hopeless of all problems, tuberculosis has become one of the most encouraging and rational objects of sanitary efforts; and the change has been due principally to the increased knowledge that has been disseminated among the laity regarding the manner of transmission of this disease and the methods of preventing it. We all realize the tremendous influence that education is having in tuberculosis, and we all recognize the profound power that educational measures may exert in all such matters; but it is very striking that we act on this so little

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as we do in the simpler ways that are open to us in the daily course of our lives. There are some very important diseases that could be controlled much more easily and more extensively under present conditions than can tuberculosis, if the intelligent public had an equal comprehension of what needs to be done in these diseases. There are others that could certainly be controlled quite as easily as tuberculosis, and most of the remainder could at least be held in check and reduced in numbers much more successfully than they can now if they also were attacked by similar educational methods.

Yet few of us accept our opportunities to help in doing this. Indeed, many physicians still hold that it is unwise to let the public know much about these things, lest they become unduly fearful and adopt irrational precautions, while many others simply feel that the results of such education are too slight with most human beings to make the effort worth while. Superficially there seems to be some reason in both these objections. Part of the public undoubtedly becomes unduly apprehensive when given a little knowledge regarding matters of this kind, and, unquestionably, with a very large proportion of humanity, teaching has little effect. Yet after all the hysterically apprehensive are a comparatively small fraction of human kind, and not an important one, if tact is used in spreading information; and as to the unreceptive, while they are numerous, they are the very ones that have little influence on the course of the world, and most of them go with the stream, if the current becomes strong enough. The objection that people can not comprehend the meaning of these things is wholly erroneous. If technical knowledge is valuable to the lay public it can always be made comprehensible.

The first thing desirable, to my mind, is a greater dissemination of exact knowledge among the laity regarding the way in which different infections spread, and the methods of preventing this; and this knowledge must come, in large part, not through writings and public meetings, valuable as these are, but through the daily and intimate contact of the practitioner and his patients, and through the acceptance by the practitioner of every opportunity to disseminate simple but correct information regarding these matters. If this is carried out somewhat extensively it will put a stop, I am sure, to a large part of the friction between health boards and practitioners. Much of the difficulty that arises over the intervention of health boards is due to a natural human impulse to rebel when misfortune makes things unpleasant; but a great part of the trouble is due to ignorance, especially to ignorance of the meaning of many of the details that are enforced. A clearer understanding does away with a good deal of the resentment. There will always remain very stupid or very selfish patients, and even doctors. With these force alone will work; but with a somewhat general enlightenment of patients through doctors there will come likewise, on the other hand, a lessening of that not uncommon feeling on the part of health boards that the people they have to deal with have in large part criminal instincts and must be treated accordingly, and there will certainly be a spreading of education among the subordinate officers of health boards in the gentle arts that spring from tact and human kindness. Ignorance in the laity, and tactlessness and thoughtlessness in a few subordinate health officers, are, I think, of about equal influence in producing friction in administering health regulations. A large part of the success of the speaker

who is to follow me has been due to his exceptional capacity for carrying out his duties tactfully and without friction.

As to the second reason that the practitioner occupies a position of great power in controlling these diseases, the fact that he guards the critical point in the defense against infections has become apparent through an overwhelming collection of testimony concerning another fact that has long been logically evident, namely, he in a large proportion of instances has the power, by relatively simple means, to limit the infection to the patient, while if it gets beyond that point it may be disseminated so quickly and so widely, and its course may then be so nearly impossible to follow, that it can never subsequently be known that it has been completely destroyed, and it often takes enormous expense and effort to prevent widespread harm. This is, of course, perfectly apparent in connection with the diseases that are highly contagious, and also in connection with those that are freely spread by means of water or food. We have very many records, for example, of the unfortunate instances in which careless management of one case of typhoid fever has caused devastation in a near-by community through infection of the water supply or the milk—all of which could have been prevented by a few simple orders given by the physician and by his seeing that these orders were carried out. But the importance of very exact regulation of the sick in all sorts of serious infections has been strikingly emphasized and illustrated in recent years by a mass of investigation that has become so convincing that, even if in a few details these are not yet quite justified, we should, nevertheless, for safety's sake, make for ourselves two propositions to guide us in some of our most important regulations with the sick.

THE QUESTION OF CONTAGION AN ACADEMIC ONE

The first of these is that the question whether this or that infectious disease is contagious or not is now, at best, an academic rather than a practical one. Some infections can be transmitted to human beings only by going first through some lower animal; but, given the presence of that suitable intermediate host, they may reappear very quickly in those immediately surrounding the patient or in others that are at a distance. All other infectious diseases, so far as we clearly know, may be, and at times are, directly transmitted from one human being to another. Both classes are transmissible, and the question whether they are what we have called contagious or not is now a wholly indefinite one. The practical questions at present are: In what ways is the disease dangerously likely to be transmitted (that is, by ordinary contact, by food or by water, etc.)? How readily is it transmitted directly under ordinary conditions of contact? How readily and in what ways may transmission be prevented?

The question as to the danger need not be answered in connection with the highly contagious diseases. It is too well answered already by years of experience. As to the common infections that were not long ago classed as non-contagious, I may say this: We have grown well accustomed to looking on tuberculosis as having often been directly transmitted, and all the recent observations greatly emphasize this and make the more remote forms of indirect transmission—even street dust—appear much less important than they have seemed. Recently we have been overwhelmed with a great mass of evidence of the importance of contact infection in

typhoid fever. So important may this be that controlling it may suffice to control a whole local epidemic, as Koch showed in the investigation that was largely responsible for the recent agitation of this question; and Reed, Vaughan and Shakespeare have shown that contact was chiefly responsible for the terrible extension of this disease among the soldiers during the war with Spain.

As an illustration of the extent and the reality of the danger in this disease I may mention that a careful study of over 200 cases under my care, carried out by Dr. Despard, showed that the history indicated strongly that contact was responsible for over 17 per cent. of them, and that in about 8 per cent. more contact was a highly probable cause: an illustration of the fact that, even when we have an active water infection, as we have had in Philadelphia—and, indeed, because we have such a source of cases—contact is very important in spreading the disease. I have also shown that in some general hospitals the whole group of nurses in the hospital are in from six to nine times the danger of the average citizen, though the latter is largely exposed to water infection and though the morbidity of the citizens in Philadelphia has been dreadfully high. With those nurses who are actually engaged in nursing typhoid fever the danger is unquestionably fifteen to twenty times that of the general public, and possibly more than this.

We now recognize equally well that dysentery may be, and often is, transmitted by ordinary contact; and this fact has repeatedly been of terrible significance in institutions, particularly in institutions for the insane, in which generally reduced resistance, together with a lack of appreciation and observance of ordinary care of the person, has often led to a wide spread of the disease. As to the relation between contact infection and the infectious digestive disorders of infancy and early childhood, every observing practitioner is well acquainted with instances in which these have gone through families of little children; and one can hardly ask for any more emphatic evidence of the seriousness and frequency of this matter than the fact that pediatricists are so afraid of such infections that most of them attempt to get babies out of hospital wards as soon as possible after any acute illness, chiefly because of the danger of infections of this sort. Similar gastrointestinal infections are transmitted among adults at times, though such transmission is less frequent with them than with little children, because their resistance to these infections is greater. If, however, from any cause, their resistance becomes decidedly reduced, there is little doubt that they are frequently and sometimes dangerously infected in this way. From observations that I have recently published I am pretty thoroughly convinced that when groups of cases are being treated together, as occurs in hospitals, the serious abdominal complications of typhoid fever may be, and often are, passed from patient to patient through passing on secondary infections which give rise to the complications.

As to other diseases, I need only mention as illustrations a few facts. Pneumonia is known to be at times directly transmitted, and while most persons appear to be resistant to this disease under ordinary conditions, direct transmission may become exceedingly important when the surrounding persons have become reduced in resistance through illness or bad conditions of life. Pneumococcus infections elsewhere than in the lung, especially in the upper air passages, are undoubtedly

a great factor in the continuance and spread of pneumonia, and these are often very readily transmitted. Meningococcus meningitis appears from recent studies to be, contrary to previous ideals, in all probability usually transmitted by human contact. It is now common knowledge and common experience that influenza, tonsillitis, coryza and such conditions are extremely readily acquired by contact. Thus we see that, with varying degrees, in all the common diseases contact infection plays a rôle, in all a rôle of some importance, and in most of these diseases it is increasing in recognized importance constantly, as we learn more of it. Even in a disease that is as yet classed as an infection only by inference, namely, acute anterior poliomyelitis, a very recent statistical study by Holt and Bartlett has shown that the evidence of direct transmission is at least sufficient to make one pause and reflect. We have, then, in the increasing and already great importance of direct transmission of practically all common diseases, very forcible evidence of the necessity for careful and precise regulations with each patient, in order to prevent the spread of any of the serious infections and to limit the milder ones as much as can reasonably be done.

THE IMPORTANCE OF UNRECOGNIZED INFECTION CARRIERS

The second proposition that we should make is that in great numbers of cases and in many diseases it has now been clearly shown that persons who come into contact with infections frequently harbor the germs of the disease for a long time, even though they show none of the ordinary evidences of it, and also that persons apparently long convalescent from infectious diseases often do the same thing; and in this we have a source of infection comparatively recently recognized, a modified form of contagion, so far as symptoms or their absence go, but a very real form of contagion, and a highly important one, in two ways: first, in that it demonstrates a new source of danger and a new thing to be controlled; and, second, in that it goes far to clear up the mystery as to the source of the very numerous cases of infectious disease that could previously be traced to no source, and that could be explained only by a hypothetical distant atmospheric transmission or some such mysterious means. These cases have carried home to us, as nothing else has done before, the importance of contact infection in a multitude of diseases. A quiet sneaking sort of contact infection it is when the person carrying the infection is apparently well, but direct contagion it is, nevertheless.

Such observations are an old and familiar story with diphtheria now. I have myself seen five localized outbreaks of diphtheria in the past four years in which the infection was clearly demonstrated to have been spread about by supposedly healthy or supposedly long convalescent persons, who were actually carrying virulent bacilli. Unquestionably this is an enormously important thing in diphtheria and is the method by which many transmissions of this disease occur. We are likewise familiar with those unfortunates who go about, sometimes even for years, leaving a trail of typhoid fever behind them; and we are approaching the point at which it would appear that pneumonia propagates itself largely in this secretive way. Most persons, in ordinary circumstances, are resistant to the pneumococci that they carry themselves or meet in others, but when in a state of lowered resistance, if they happen to

be carrying a virulent strain themselves or come into contact with some one who has such a strain, they fall ill with a pneumococcic infection which may become an actual pneumonia. Thus, the striking fact that most human beings carry pneumococci about with them is no longer a mere curious phenomenon that would seem to lessen the importance of this organism in that disease. On the contrary, when properly comprehended, it becomes a more grave and significant fact than ever before.

With meningococcus meningitis the circumstances appear to be very similar. Observations such as those of Elser and others in this country, and of Ostermann in Europe, make it appear highly probable that the odd way in which this disease spreads is explained: that most persons who are exposed are not susceptible, but that many of them carry the cocci for some time afterward. While only a few sicken in evident relation to other cases, the spread of the disease appears to be usually through contagion, nevertheless; for the cocci may be passed on from one to another, without any one of them knowing this, until finally a susceptible person falls ill. By this time the relation to the original case may be wholly obscure. Any one who, with our present knowledge, does not isolate this horrible disease is dangerously indifferent or dangerously conservative.

A study of those who have unconsciously acted as infection carriers has already marvelously illuminated the whole question of infection and will light up this question still further. Midway between this source of infection and contact with persons who are evidently sick with a recognized disease lie a group of cases that also are growing increasingly numerous and increasingly important, as we come more and more to the point of making our diagnoses in infectious conditions on bacteriologic grounds, rather than on the situation and the character of the symptoms and physical signs—those cases, I mean, in which there is evidently an illness but in which there is not what we have been accustomed to depend on as the clinical picture of a particular infection; cases, however, in which bacteriologic study shows that there is actually a disease which is known to be readily transmissible. These cases are recognized to be highly numerous at present. We are now familiar with the running ears that may spread diphtheria widely, with the fact that an ordinary "cold" due to a virulent strain of pneumococcus occasionally gives someone else a pneumonia, and with many similar occurrences—all pointing toward contact with the sick as a profoundly important source of infection.

All this, brought down to its essence, means that the infected human being is coming daily to occupy a more and more important position, and is approaching a position of supreme importance as the source of infection in others. Even in diseases such as typhoid fever, in which a large proportion of the infections occur through water or milk, this takes place, not because there is some essential dependence of the disease on water or milk, but because these fluids have recently been infected through the imperfect care of a human case, or in a relatively small number of diseases it occurs through infection of these fluids through a case of one of these diseases in animals. The importance of distant infection through the atmosphere or through fomites, rubbish and the like grows correspondingly less as contact grows in importance, though the influence of bad air, dirt and many other such things in reducing resistance to disease remains great. These latter things are, of course, sometimes of direct importance in producing infection, since

some pathogenic bacteria can maintain their existence and their virulence outside the animal body for a long time, and most of them can do this for a short time; but the greater proportion of them probably can not do it very long, and hence they are dependent for their continued existence as disease-producers on continued infection of animals; and with human bacterial diseases this usually means that they are dependent chiefly on continued infection of human beings.

All this comes back to the practitioner in its loud insistence on the greatest possible care with the infected sick, if infections are to be stopped at their fountain-heads. But in this maze of infections among which we live what is the practitioner to do and what is he to teach? There are many ways in which we are as yet helpless, or somewhat helpless at least. Nevertheless, I think that the thing that we need first of all is to get more thoroughly rid of the centuries-old feeling that these diseases are purely chastisements of Providence and must be borne with resignation, and some of us need this riddance badly. The general trend of the recent investigations that I have sketched, and especially the demonstration of the existence of a large group of infection carriers who are not suspected to be such, unless chance or a somewhat laborious investigation proves it, has, with those of little courage, intensified the feeling of sorrowful resignation. These cases do, indeed, make it appear profoundly true that in the midst of life we are in death; and that with chronic infection carriers particularly we have ordinarily no means of recognizing the danger and, therefore, no means of preventing it—at least when these persons have already become infected—until some unfortunate event directs attention to them. The knowledge of their existence, however, is further evidence of our powers, rather than a source of discouragement, if we direct our efforts properly; and they force our attention more strongly toward the first point in the management of infections, namely, that with any serious infectious disease, and not only with those long known to be contagious, some degree of isolation should be earnestly recommended, and this should be made as complete as is reasonably possible. This will meet with a good deal of opposition, but it is already perfectly feasible with a large proportion of the intelligent public, and every advance that was ever made has met with opposition. With the milder infections, even with acute colds, isolation should be encouraged as much as can be done.

The principal way in which this can be accomplished is, as I have already indicated, in making the laity comprehend the reasons for it, and, as I have just said, a considerable proportion of the intelligent laity already comprehend them fairly well. Isolation may, of course, be modified according to the disease and according to the manner and the readiness of its transmission; but the chief point is to educate the people into the feeling that those sick with any acute infection should be promptly, and as completely as possible, restricted from any unnecessary contact with others. To many persons this seems an extreme proposition, but its rationality needs no argument. To many others it seems impossible that it should do much good, when so many opportunities for infection must inevitably remain open; when many patients and their families will refuse to carry out any sort of isolation; and when someone must always care for the sick, any way. The proper way to look at the matter, however, it appears to me, is to consider each person exposed as possibly starting an endless chain of

infection, the number of links in the chain being possibly doubled, trebled or quadrupled each time it is passed on. We are all familiar with the figures to which such a progression soon mounts. If we restrict intercourse with the sick, we reduce the chances of the starting of such endless chains from five or ten, or more, down to one or two. I have no doubt that, in the apparently narrow sphere of their daily work, a few practitioners can thereby often do as much to prevent disease as a city health officer can usually do in dealing with a whole city; because of the peculiar opportunity in practice to stop the infection before it takes the first critically important step. Much infection must still go on, even if all practitioners make the best efforts possible; but with careful and widespread use of the measures that we have at our command, we can unquestionably reduce greatly the number of cases, and it is only in our dreams that we have thought that infectious diseases would soon be actually stamped out.

In connection, especially with the highly contagious diseases, but also in connection with all serious infections, we need particularly to get rid of the point of view that leads practitioners very commonly to permit a number of persons to have intercourse with the sick, after having explained to them the greater or lesser chances that they may get the disease themselves or may carry it to others. This is practically, with many persons, daring them to face the disease, if they have the courage; and since, in a large proportion of instances, they learn that the chances that they will get the disease themselves, if they are in good health, or have had it before, are small, they very often do have the courage. It is not the province of the laity to decide whether they should do these things. It is the physician's responsibility; and quiet, tactful, but serious advice should be given against any unnecessary contact with any infection, more especially the acute infections. People should be plainly told that, with our present knowledge, we must consider that there is not only more or less danger to themselves, but also that, while the danger to themselves is in most instances slight, the old discussion as to whether this disease or that can be carried from the sick to a third person through an intermediary has been pretty well answered in the affirmative for all the acute infections in which we have any real knowledge of this question. People must be made to realize that unnecessary exposure to any infection is a wrong to the public. It is not a question that affects themselves or their families alone; the question is whether they will help in whatever way they can to lessen the danger from these diseases to the whole public with which they come into contact.

It will again be objected that only the very intelligent will comprehend this; and that only the altruistic will accept this point of view, if they see it. I would again say that the numbers of the intelligent increase with the spread of knowledge, and that the numbers of the altruistic increase by example; and at least many persons adopt altruistic manners and methods through the force of example, even if they do not really enjoy altruism.

The next general principle of which I wish to speak as exemplifying what we should practice and preach is that we should take earnest care to acquaint those who come into contact with the sick, especially those who must be in attendance on them, with the particularly important ways in which they may acquire the especial disease at hand or may pass it on to others; and we

should take vigilant care to see that they follow suggestions correctly and conscientiously. The latter is done less frequently than the former. Preventive suggestions are often given; but their effectiveness is a question of accuracy in detail, and anyone who takes the trouble to see in what manner the previously uninstructed carry out these measures after mere verbal instruction or hasty demonstration must appreciate the importance of taking some pains to see that things are done correctly. Even with trained hospital staffs, eternal vigilance is necessary in order to accomplish anything approaching accuracy in these matters; and with those who have previously had neither knowledge nor experience, some hasty directions, once given, will certainly do little good. Unfortunately, even the latter are not given with one-half the regularity that they should be. There seems, even yet, to be vastly less confidence in the value of prevention than in the treatment of the existing disease—in spite of the fact that everyone realizes that we have the power of saving many more lives through the former than through the latter.

As an illustration of the common laxity in this, I may mention that I went carefully into the histories of a large group of hospital cases of typhoid fever, and could not find that in 10 per cent. of them had any definite precautions been taken or suggested, in order to protect the other members of the household; and as a consequence I myself saw among this group of patients, in the course of two years, twelve instances in which from three to five members of families acquired typhoid fever, and almost certainly from the primary cases in their houses.

Only a few days ago I met with another example, when I found a small country community, ordinarily free from typhoid fever, greatly excited over the occurrence of five cases of this disease in one family. There were many speculations as to the source, but the trail of the serpent was plain in this instance. A son had come home sick with typhoid fever from a town constantly infected with that disease. The whole family had assisted at times in nursing him, and even the cook had hovered between the patient and the food that was eaten by the whole family. No instruction had been given at first as to the prevention of the spread of the infection; and the physician in attendance admitted that when the second case occurred and he realized that he was responsible, he deliberately said almost nothing about taking precautions, because he felt that insistence on regulations at that juncture would lead to his being blamed for not having established them earlier. The recording angel has against him, in this instance, one death, many months of illness *in toto* in that family, and very heavy expense to the survivors. This cheerful story is far from representing the great bulk of the profession; but it and the other instances mentioned do show that a great deal more care should be given to detailed instruction regarding preventive measures.

IMPORTANCE OF PERSONAL PRECAUTIONS BY PHYSICIANS

Finally, we need to have more faith than many of us have in the real usefulness—the actual necessity, indeed—of adopting with our own persons all the reasonable precautions available against being ourselves carriers of infection. Many physicians seem to think it embarrassing to adopt precautions, and apparently consider that it will make the laity look on them as lacking in courage and fearful of acquiring the disease themselves. It is not courage, but foolhardiness,

to expose oneself needlessly to disease; but any who prefer to be foolhardy, may still put a check on themselves by reflecting that these precautions are really less for the physician's own good than for that of the public. A large number of medical men consider these precautions an unnecessary burden, because they can see little evidence that they or others who take but little precaution ever carry disease. This argument can not hold good at the present day. Which one of these men can say, in the light of our present knowledge of chronic infection-carriers, that he has not unconsciously played this rôle himself many times, and perhaps with gravely important results? We are approaching more closely every day to the position of the surgeon and the obstetrician, who are held—and who hold themselves—responsible, if they infect a patient through neglecting to avoid not only what they can clearly see is dangerous, but also what their reason tells them may be dangerous; and who make every effort to eliminate the inconspicuous and comparatively slight sources of infection. These men have had an advantage over medical practitioners in making progress in these matters, because their bad results openly and quickly follow the cause in most instances. Our errors are much more difficult to see and to overcome, because the bad results are somewhat more difficult to prove and even to suspect. Their existence and their importance, however, have now become beyond reasonable question.

One other highly important reason that the practitioner should exercise great care in the protection of his person against infection, in disinfecting exposed parts, and in all such measures, is that he serves as the chief example that the laity have to follow; and if he evidently regards these things as of too little moment to make it worth while to practice them himself, we can not expect the laity to have much faith in the things we teach them and desire them to practice.

The standpoint that I have described is one that requires more time and effort from the practitioner than does the ordinary method of dealing with infection. Nothing that is worth doing, however, can be done without effort. I am convinced that this is the way that those who wish to be in the vanguard must look on the matter, and I am equally sure that it will not be long before the intelligent public will be learning these things pretty generally, as they have already learned the important facts regarding tuberculosis and its prevention and treatment. They will then require of us in other diseases the same advanced attitude that they now know that skillful practitioners should have in tuberculosis. All this must add somewhat to the time and care devoted to infectious cases. I am fully aware that it means some extra tax on the practitioner's strength and patience, but I have touched on some of the matters that I have included, rather than leave them to one of the speakers announced to follow me, to whom they may in some ways seem more properly to belong, because if I preach, I am at least preaching what I myself have to practice, whereas if they alone say these things they might in their positions seem to be preaching only what they would have others practice.

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Gonococcus in Puerperal Fever.—F. B. Gurd, in *Montreal Medical Journal*, states that the gonococcus, either alone or as a primary infecting agent, plays a much more important rôle in the production of puerperal fever than is usually appreciated by most observers.

THE AMOUNT OF INFECTION AND REASONABLE SANITARY STANDARDS *

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It is not generally appreciated that it requires a certain amount of infection to induce disease. While an acute specific disease is the result of a reaction between two living organisms, the host and the parasite, nevertheless, in the vast majority of instances, it requires a certain amount of the infecting principle on the one hand and a certain degree of susceptibility on the other hand, to produce the fever and other constitutional disturbances we call "the disease."

These two factors are more constant than is commonly supposed. All individuals of a given species usually have about the same susceptibility to a particular infection. Exceptional individuals may occasionally show wide variations, some being especially susceptible, others unusually resistant. These exceptions are rare enough and conspicuous enough to emphasize the rule. Thus, almost all persons are about equally susceptible to smallpox, whooping cough, measles, tetanus, mumps, dengue, yellow fever, plague, scarlet fever, and most of the acute specific diseases, provided certain amounts of the infectious principle are actually introduced into the organism, and provided, of course, that they have not had a prior attack, nor been treated by special means to raise their immunity, etc.

It is wonderful how uniformly the lower animals used for experimental purposes in the laboratory react to bacterial poisons. A given amount of tetanus or diphtheria toxins injected into guinea-pigs is followed by such constant results that these animals are a reliable and satisfactory measure of the strength and concentration of these poisons. So constantly and uniformly do the guinea-pigs react in this regard that they serve the purpose of an accurate analytical balance to measure the potency of these toxins and their antibodies.

Animals show also uniform susceptibility when inoculated with the living cultures. Thus, a twenty-four-hour-old culture of plague, glanders, anthrax, streptococcus, etc., may be depended on to produce surprisingly constant and uniform results when injected in definite quantities and under similar conditions into individuals of the same species.

On the other hand, it is well known in every bacteriological laboratory that, no matter how virulent the culture and no matter how susceptible the host, there must be a certain number of micro-organisms present to obtain a positive result. It has been estimated that it requires at least thirty tubercle bacilli in the peritoneal cavity of the guinea-pig to produce tuberculosis. Although many animals are very susceptible to plague, it requires a definite number of plague bacilli to produce the disease. The same is true of diphtheria, tetanus, anthrax, glanders, streptococci and other micro-organisms that are usually classed among the most virulent of the infections. It is especially true of the pyogenic cocci and the pathogenic group of coccobacilli.

On account of the power of bacteria to grow and multiply within the body, the initial amount introduced

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