

to make the course four years at the expense of cutting down the length of each year, is not advancing. Students who have five months' vacation will not graduate from college as well equipped as students who have only three months' vacation. Some argue that the students get so tired they need five months' vacation. Others argue that students ought to have five months to work to earn money to finish their course. Neither of these arguments is worth considering. If the course is to be lengthened, let it be made four years of nine months each. A plan could be adopted requiring a degree in arts and letters for admission, as well as a manual school training, and then three years of good, earnest work would turn out good dentists.

DR. M. L. RHEIN, New York, said that possibly the colleges that have a six months' course are in the South, and they would have a six months' course whether it was three years or six. It has always seemed difficult to get southern colleges to give any lengthy term. The tendency in the northeast has been to increase the teaching term whatever the number of years. Dr. Rhein thinks the basis for dental education should be absolutely as high as that of medical education, and until that standard is reached dentists are below their true standard, and that is the only thing that keeps dentistry from being recognized as it should. It is the one thing that keeps students of the proper caliber from taking up this specialty. They do not care to place themselves on a lower plane than any of the other branches of medicine. This section should strive to make the requirements of dental education as high as that required for medicine, and to keep them up to that standard. Dr. Rhein thinks it impossible for a man to practice this branch of medicine without being thoroughly grounded in general medicine. The groundwork of medicine is recognized as being not only of value but of necessity, and while dentistry is a technical work, and while a technical school is of the utmost importance, without the scientific knowledge of medicine the dentist is at a loss to properly apply his technical knowledge.

DR. A. H. LEVINGS, Milwaukee, said that there are many subjects in the medical curriculum which would be of no use to the dentist, though a dentist must have some knowledge of the fundamental branches, such as chemistry, pathology, bacteriology, histology and therapeutics. He must have some knowledge of surgery and perhaps a smattering of medicine, but Dr. Levings thinks that the study of neurology, gynecology, obstetrics, dermatology, otology and allied subjects would be of no benefit to the dentist commensurate with the time spent in study. If the coming dentist were required to take a full course in medicine, he would have to spend an extra year in mechanical work, because the medical student's time is fully occupied. He can not complete the course of to-day in less than four years of eight or nine months each. Dr. Levings said that he has heard many say that the requirements should be put so high that but few dental students could meet them. The only consideration should be what is best for these prospective dental students. Dr. Levings appreciates as much as anyone that the more culture, refinement, education and mental training an individual has, the higher he can rise in his profession, and the more easily he can maintain himself, but it is not within the possibility of every prospective dental student or every prospective medical student to secure the standard. Such a course as is given now in dental colleges will train any man who has a high school education so that he can master all the problems pertaining to either dentistry or medicine. Those who have the time and money may take a medical and a dental degree, and before this an A.B. degree, and polish themselves as much as possible.

DR. M. I. SCHAMBERG, Philadelphia, said that it may take some time before dentists will reach a higher standard than that existing at the present time. To his way of thinking, there are two things of prominent importance in taking up this subject: one is the raising of the standard of the profession, and the second, which he considers even more important, is the placing of such men in the dental world as are able to render the best possible service to humanity. The financial status of the dental college should be absolutely ignored. It may be that the work of the stomatologist and the dentist

will ultimately become separated before arriving at the desired goal. If that be the case, it will probably be best for humanity at large. Dr. Schamberg would prefer to see the various dental institutions under the control of state universities, so that the financial side of the question would not enter into it so much as the educational.

DR. G. V. I. BROWN, Milwaukee, said that in this question of dental education a distinct advance of some kind is wanted. The purpose of Dr. Chittenden's paper is to fulfill the crowning act of a long life that has been given freely to the up-raising of the standard, that before he dies something definite may be accomplished in the establishment of a higher standard of dental education. Dr. Brown said that he drew the resolution in the faculty association regarding the four-year term, and he has made more or less of a battle at different times for the four-year course. It is useless to discuss at this time the value of such a course because for the time at least it has been decided to be inadvisable. He believes that the additional year could be secured with less hardship to the schools and with more likelihood of its being practical than any other advance. He believes every argument that has been made about the mechanical side of dentistry, and that since there can not be a four-year course there ought to be higher entrance requirements, and that the course should be at least nine months, or as near that length as possible. Dr. Brown is connected with schools in the South and in the West. He sees both sides of the question, but at the present time no plan has been suggested which is practicable for meeting the situation. When some one presents a plan which will carry with it a distinct advance, so long as it is an advance which will enable the colleges of the South, West and elsewhere to continue and to prosper, that plan will meet with approval, and when that time comes he has no doubt the examiners' and faculty associations will again be on a harmonious basis. Dr. Brown believes in the value of having dental colleges under state control, but even under this condition it is not all smooth sailing by any means. At this time it seems nothing beneficial can be accomplished by discussion alone.

DR. H. P. CARLTON said that he has never yet written a paper of this character nor spoken his thoughts along this line, that the discussion did not at once turn to the question of courses and years. He wants to establish foundation courses and to leave the length of courses and curricula out of the question. He hopes to live to see it proved that the dentist of the future is going to be a medical man. The more a man gets in brain development the better dentist he will be. A man can not be too broad and too scientifically trained to be a dentist.

RECENT PROGRESS IN MATTERS OF WATER SUPPLY AND SEWAGE DISPOSAL.*

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Of the various topics in this branch of sanitation there is none which has received so much discussion during the past year as that of the proposed use of copper sulphate. This chemical has been proposed for various purposes, the chief of which are as follows:

1. As an algicide; 2, as a germicide for infected water supplies used without subsequent filtration for drinking; 3, as a germicide for the effluent of coarse-grained sewage filters prior to entering drinking water streams; 4, as a germicide in conjunction with a coagulant in the filtration of highly polluted streams.

COPPER SULPHATE AS A GERMICIDE.

Although copper sulphate as a germicide and disinfectant has been studied from time to time for many years, especially in Germany during and after the se-

* Read in the Section on Hygiene and Sanitary Science of the American Medical Association, at the Fifty-sixth Annual Session, July, 1905.

vere outbreak of cholera in 1892, this question has recently pressed forward for attention, largely due to the very interesting bulletin prepared by Dr. Moore and Mr. Kellerman¹ and issued in May, 1904. A second bulletin by the same authors was issued in April, 1905, and it appears from it that more than fifty reservoirs and ponds have been treated during the past year with copper sulphate to remove various forms of algal life producing objectionable tastes and odors.

To repeat these various experiences is needless here, in view of their having been detailed elsewhere and summarized in the more important instances in the last bulletin referred to.

When attention was directed to this matter last year, as is usually the case under such circumstances, public opinion varied widely in regard to it. On the one hand, were those who approved and supported the proposition most cordially and were inclined to regard it as a cure-all, while, on the other hand, were those of a more dubious frame of mind who were uncertain as to whether with ordinary care the copper sulphate might not become so unequally distributed in the water as to become injurious to the people drinking the treated water, and who were somewhat skeptical as to the ability of this chemical to kill vegetable life, at least under some conditions.

As a result of various experiences, copper sulphate as an algicide now appears to be viewed somewhat more favorably than it was a year ago. When water infested with algæ is to be filtered carefully after treatment, the process appears safe, provided the copper sulphate is applied uniformly in small proportions and is precipitated by the water.

When copper sulphate is applied to waters used for drinking purposes without being filtered following the treatment, a number of eminent professional men have felt disposed to advise against its use until further information concerning it is available. This position seems to be a conservative and prudent one ordinarily to adopt at this time.

Doses of copper sulphate of one part in from 1,000,000 to 10,000,000 parts of water usually suffice to kill algæ. Sometimes the doses are much more dilute, and in a few instances the strength must be about one part per 100,000.

It is not clearly understood into what form the chemical is converted when applied to various waters. Also uncertain in the minds of some is whether or not the passing of an abnormally large proportion of the copper from the reservoir in a relatively small portion of water is due to disturbances of the precipitated copper.

In this review it is needless to discuss more or less conflicting evidence on a variety of topics allied to this subject. It is sufficient to point out that opinion is not harmonious to a satisfactory degree on the following points:

- (a) Toxicity to man of copper sulphate and salts in quantities encountered under various conditions.
- (b) Chemical reaction of copper sulphate with constituents of various waters.
- (c) Immunity and stimulation of other vegetable growths.
- (d) Effect of copper sulphate on various fish.
- (e) Disposal of copper under varying conditions of application.

1. Bulletins Nos. 64 and 76 Bureau of Plant Industry of Department of Agriculture.

COPPER SULPHATE AS A GERMICIDE FOR UNFILTERED WATER SUPPLIES.

This use of copper has been widely studied in the laboratory and has been put into practice in a number of places where public water supplies are known to be of unsatisfactory quality and where high death rates from typhoid fever prevail. Some misunderstanding in regard to this subject has occurred, and the general public in a number of communities appears to have gathered the impression that copper sulphate applied with this end in view serves as a substitute for filtration. Evidently this is not the view of the government officials who have looked into this matter, as they claim that the process is applicable in places where filter plants have not yet been built, and where during the period of filter construction unfiltered water of a dangerous character is supplied to the consumers.

Another aspect of this same matter is, of course, the use of copper vessels, such as canteens, etc., for obtaining water free from objectionable germ pollution.

It is very clear that copper sulphate can not serve as an adequate substitute for properly constructed and properly operated filtration works. In the case of adequate filters giving poor efficiency due to improper supervision, it is debatable whether, other things remaining equal, copper sulphate would or could be used so as to insure better results. Where filter works do not now exist, the feasibility of this treatment may be considered. This also applies, perhaps, to the treatment of water in this way in small receptacles.

It seems to be the consensus of opinion of quite a number of prominent sanitarians that a final opinion on this proposition of using copper sulphate as a germicide for drinking waters without subsequent filtration ought to be deferred until available data are more complete and trustworthy than they are at the present time. When this condition of affairs is reached it is not probable, in my opinion, that there will be material differences of opinion among experienced sanitarians.

Laboratory data on typhoid germs artificially cultivated for comparatively long periods do not necessarily afford a reliable criterion as to the quantity of the copper sulphate required, nor the period of contact necessary in order to effect, or even to approach, sterilization under conditions of practice. Depleted vitality in this connection may quite likely be of as much importance here as it is in species determinations. Laboratory data, furthermore, are seriously involved by questions of osmosis and other features which, independent of the copper sulphate added, in laboratory experiments cause typhoid and other germs to die more quickly than can be relied on in practice.

Concentrations of from 1 in 100,000 to 1 in 50,000 seem necessary for sterilization of infected water. Experiences such as those recorded at Columbus, Ohio, by the city health officer and summarized in the last bulletin of the U. S. Department of Agriculture do not seem to cover sufficiently the various essential facts to entitle them to great weight. In fact, I am certain that there are many reasons for believing that in the experiences with the city water supply of Columbus too little is recorded of the actual condition as to infection of the treated water and also of the prevalence of typhoid fever after the treatment ceased to justify the conclusion that doses of copper sulphate of less than 1 per million actually destroyed typhoid fever germs in a few hours.

COPPER SULPHATE AS A GERMICIDE FOR THE EFFLUENT OF COARSE-GRAINED SEWAGE FILTERS.

Since it is now a well-established fact that coarse-grained sewage filters, more frequently spoken of as contact beds and sprinkling filters, are capable of producing at fairly high rates of filtration effluents of a non-putrescible character, sanitarians have given more or less thought to the question of the hygienic significance of such effluents, since it is known that they do not remove disease germs with such thoroughness as intermittent sand filters. Further, as these sewage filters seem to be the only ones available in some sections of the country, where porous layers of sand or gravel are not to be found, the sterilization of these partially purified sewages is a matter which doubtless will receive attention in the future. At present little need be said other than that the process is a somewhat expensive one, according to investigations at the Sewage Testing Station at Columbus, Ohio, by Messrs. Johnson and Copeland. They find that to kill typhoid germs in sewage effluents it is necessary to make an application of about 1 in 50,000, the cost of which at current prices is in the neighborhood of \$8 a million gallons.

The composition of the sewage with reference to alkalinity and organic matter, temperature and period of contact are more or less important matters which require further elucidation. The applied copper salts in these proportions produce a noticeable precipitate, the deposition of which requires consideration.

COPPER SULPHATE AS A GERMICIDE IN CONNECTION WITH FILTRATION.

At Anderson, Ind., during the past winter, copper sulphate was applied to the water just prior to filtration and in conjunction with sulphate of iron and lime as coagulants. These experiments were made for a comparatively short period with a new filter plant, the construction of which was not at that time fully satisfactory in all particulars. The investigations were conducted by Professor Burrage on behalf of the city, and Mr. C. Arthur Brown, representing the contractors for the filter plant and also the American Steel and Wire Company, which places sulphate of iron on the market in large quantities. Several other bacteriologists and chemists were present, including representatives of the United States Department of Agriculture. The claims made of the beneficial result in killing bacteria by adding minute quantities of copper sulphate, such as 1 in one million parts of water or less, do not harmonize with a considerable amount of information obtained elsewhere. Especially inconclusive are tests for *B. coli communis* in 1 c.c. of water before and after filtration. Later tests have been made at a new filter plant at Marietta, Ohio, but the data are not yet available to the public. Still further tests are doubtless needed under a wide range of conditions before opinion on this phase of the subject may be safely reached.

WATER PURIFICATION.

Recent progress in this field has been confined largely to the application of the principles hitherto developed carefully along a scientific scale. It is highly gratifying to note that works are now being built for a number of the larger cities in this country, including Providence, R. I.; New Haven, Conn.; Hoboken, N. J.; Harrisburg, Pa.; Philadelphia, Pa. (partially completed); Washington, D. C.; Pittsburg, Pa.; Columbus, Ohio; Louisville, Ky., and quite a number of other smaller cities. Active steps toward securing filtered water also seem about to be taken at Cincinnati, Ohio;

Toledo, Ohio; New Orleans; Troy, N. Y.; Wilmington, Del., and Minneapolis.

An interesting feature in connection with this subject is the number of reports made recently by prominent engineers in which filtration is advised of water supplies which a short time ago were regarded as of a quality not requiring filtration. The most prominent instance on record is that of the supply of New York City, where, as is well known, there has been an unusually low typhoid fever death rate for an American city for many years—since elaborate undertakings were made for the elimination of sources of pollution on the Croton watershed.

As to the extent to which filtered water from surface sources is now used in this country, reference is made to the important paper presented by Mr. Allen Hazen at the International Engineering Congress at St. Louis in the autumn of 1904. In the statistics therein presented, it is pointed out that in 1904, of an estimated population in the United States of 32,700,000 in towns and cities of more than 2,500 inhabitants, there are about 3,160,000, or 9.7 per cent., which are supplied with filtered water. Of this number, about 2,600,000 received water from mechanical filters, and the remainder, about 560,000, are supplied with water from sand filters. During the past four years, according to these statistics, there has been an increase of 70 per cent. in population supplied with filtered water, and this increase, from what has already been said with reference to large purification works now building or soon to be completed, will, no doubt, advance still more rapidly in the near future.

As still further indicating the extent of the present use of water filtration works, it was pointed out in the paper mentioned that, of all cities in the United States having a population of more than 25,000, there were 7.9 per cent. provided in 1904 with filtered water; 11.4 per cent. had filters under construction; 21.4 per cent. had filters either authorized or recommended officially; 31.1 per cent. had water of a sanitary character requiring either filtration or a new supply; 22.2 per cent. had water of reasonably satisfactory quality and probably not needing filtration for a long time, and 6 per cent. had water of good quality not requiring filtration.

There is no feature connected with water filtration of more interest to the sanitarian than the effect which these improvements in public water works produce on the health of the community adopting them. It is gratifying to note that a considerable proportion of the recently constructed filter plants are now operated in quite a satisfactory manner, while the larger ones are provided with superintendents possessing all the needed skill in chemical and bacteriologic technic. These more recently constructed filters, operated under intelligent supervision, have produced very marked reductions in the typhoid fever death rates in the communities in question, and, as pointed out in the paper by Mr. Hazen, they have affected also a material reduction in the general death rate. This latter feature is, of course, associated with quite a number of other factors, as is also true of reductions in typhoid fever death rates; but, generally speaking, it may be said that filtered surface waters in several communities have caused death rates to appear as low as in other communities similarly situated in which ground water of unsuspected character is supplied. Unquestionably, further investigation and elucidation are needed in order to establish clearly the significance of matters of water supply and sewage disposal with reference to vital statistics. In brief, how-

ever, it appears that pure water is a sanitary feature of predominant importance, and there is no doubt about the substitution of a pure supply for an impure one having in repeated instances reduced the death rate to an extent practically unequaled by any other single sanitary improvement.

Nearly all recent improvements, both as regards sand filters and mechanical filters, refer to those features of design which relate, first, to means of securing a more reliable and automatic control of the process, and, secondly, to means of reducing the cost of operation, largely by the elimination of hand labor, due to improved mechanical appliances. In mechanical filters, this has come about largely through automatic regulating devices and the larger size of individual units, and in sand filters in devices for reducing the labor in cleaning the filters. In the latter, matters have advanced even so far as to the question of considering mechanical scrapers for cleaning the sand surfaces (Pittsburg).

Recently the city of Columbus, Ohio, situated in a section where the water supply, both from surface and ground sources, is very hard, put under contract a municipal purification plant of 30,000,000 gallons' daily capacity, which will not only filter the supply, but will also enable it to be softened. While there are many industrial softening plants in this country, and small town plants at Winnipeg and Oberlin, this is the first instance on record in this country where a large city has undertaken thoroughly to soften the water supply.

Much attention in the public press has been given to the recent method of treating the St. Louis water supply. This water, taken from the Mississippi river, has for many years been partially clarified by sedimentation in large open reservoirs. Early in 1904, as a preparatory step for the St. Louis Exposition, this water was further clarified in the same reservoirs with the aid of sulphate of iron and of lime as coagulants. In other words, the water was treated in a manner very similar to the treatment of sewage in the chemical precipitation works at Worcester and Providence and in many places in Europe. The result has been a far better clarified water than was the case previously. In fact, ordinarily the supply has been of satisfactory appearance.

Several statements by St. Louis authorities have appeared which indicate that this method is a complete and effective means of securing a water of satisfactory appearance and hygienic quality, and that filters are a superfluous institution. The facts do not warrant this position, as unquestionably filtration would improve the water supply of that city.

Sulphate of iron and lime in connection with filtration is a serviceable substitute for sulphate of alumina for some waters, but not for all. In some instances, the composition of the water makes it very difficult to guard against objectionable quantities of lime or of iron appearing in the filtrate.

PROGRESS IN WATER SUPPLY CONTROL.

There have been two steps taken in this country during the past year with reference to the control of water supplies which are of much interest to the sanitarian. The most notable of these is the establishment of a state department of health in Pennsylvania, with ample laws to bring to a higher grade of efficiency the sewerage and water systems in the various cities in that state, which has suffered quite severely for years from typhoid fever. It is gratifying, also, to note that the legislature in Pennsylvania has made a reasonable appropriation for carrying out these new laws in an efficient way

so far as making it possible to provide a skilled staff of technical advisers and assistants is concerned.

The legislature of the state of New York also recently created a state water commission, with an appropriation of about \$40,000. The object of this appears to be to investigate available supplies within the state with reference to seeing that there is an equitable arrangement made for the various large communities, including New York City, taking new supplies from sources well considered in the interests of all concerned. Projects for new supplies, it is understood, are required to be submitted to this state commission.

SEWAGE DISPOSAL.

I reviewed this branch of sanitation in its various aspects in a paper prepared on this subject for the International Engineering Congress held in St. Louis last October. In this paper it was pointed out that in towns of the United States of 4,000 population or over in 1900, of which there were 1,049, with a total population of about 28,000,000, there were about 20,400,000 people estimated to be discharging raw sewage into inland streams or lakes; about 6,500,000 discharged their sewage into the sea or into the harbors or tidal estuaries along the sea coast; while the remainder, about 1,100,000, were connected to sewage purification works.

As compared with most European countries, the population in this country is so scattered, the rivers are so large and the rainfall, for the most part, so much greater and more evenly distributed, that this relatively small proportion of sewage purification works indicates by no means that this country is so backward as some might seem inclined to think with reference to adopting purification works where they are clearly needed. There are, of course, quite a number of instances where sewage purification works are badly needed in this country; but, generally speaking, there are more efforts now being made toward the purification of the sewage of larger towns than has been the case hitherto. This is partly because of the status of local lawsuits and injunctions, and partly owing to the more adequate information now available indicating the best and cheapest way of purifying sewage under various local conditions.

Information on the subject of sewage purification still continues to be forthcoming each year from the important investigations which for 18 years have been systematically and uninterruptedly conducted by the Massachusetts State Board of Health at the Lawrence Experiment Station. In the annual reports of that board for the years 1902 and 1903 are especially valuable reports indicating the experiences not only with the various sewage purification works in that state, but also the conditions resulting from discharging the sewage of various cities under different degrees of dilution into neighboring water courses.

Generally speaking, it is found that nuisances are avoided when a stream provides a dilution during dry weather of about 3.5 cubic feet a second for the sewage of each 1,000 population connected with the sewers. Where manufacturing wastes are unusually extensive, it is sometimes necessary on small streams to provide a greater dilution than this to guard against nuisances. On large streams it is possible that this dilution may be slightly greater than needed in some cases.

As to that aspect of sewage disposal by dilution, which involves the question of infection of water supplies taken from streams a considerable distance below the entrance of sewage, it is to be stated that, while information has increased considerably, especially in con-

nection with the testimony recently taken with regard to the litigation over the Chicago drainage canal, views are not as yet clearly crystallized. It is largely a question of time interval elapsing under various conditions of stream flow between the point of discharge of sewage and the withdrawal of the water for drinking purposes at points below.

Elaborate investigations made by Drs. Jordan, Russell and Zeit indicate that the life of typhoid fever germs may be somewhat shorter than has hitherto been considered to be the case. This, however, is still a debatable proposition, notwithstanding the general acceptance of the idea that various species of bacteria exert a more or less antagonistic influence in water on typhoid germs. Parchment sacks have in some ways improved the technic of these studies, but at Columbus, Ohio, Messrs. Johnson and Copeland have found apparently that these sacks when free from punctures do not prevent motile bacteria from passing through them.

Information from all sources, when plotted on a diagram, indicates that about 90 per cent. of typhoid fever germs in waters of various classes will live in decreasing numbers for periods ranging from 3 to 13 days, although it is quite uncertain how long the last 1 per cent. survives. Some of these bacteria undoubtedly live for a considerably longer period than one month.

There are about 90 sewage purification works of artificial construction now in existence in this country, and serving, as above indicated, a little over 1,000,000 population. Recently, on an average about half a dozen plants in large towns or cities have been constructed each year.

Based on practical experience and observation in the sewage purification field, and on observations made at considerable length at the Lawrence Experiment Station and elsewhere, it may be said that when porous sandy soil is available at small cost, this still appears to be the cheapest as well as the best method of purifying sewage. There are about 40 such plants now in existence in this country, serving a population in the aggregate of about 250,000.

The principal objection to sand filters is their clogging during cold weather, resulting then either in a material reduction in rate of filtration or in by-passing the filters entirely. It is as yet uncertain how far it is advisable to give sewage a preliminary purification before application to sand filters.

In the South and West, where porous sandy soil is not available, or in the East where it is expensive at suitable sites, it becomes necessary to consider other methods of filtration. The two principal types of coarse-grained filters are called contact beds and sprinkling filters. In each instance, they are composed ordinarily of fairly coarse material, ranging in size from about one-half inch to two inches. A contact bed is operated by filling the pores of the filter, letting the filter stand for a short period and then slowly draining out the sewage. Ordinarily the filters can be filled in this way three times daily, but from time to time they require resting. This method, particularly when double filtration is practiced, permits an effluent to be obtained which is non-putrescible and quite satisfactory for discharging into a stream. With sprinkling filters the unfiltered sewage is applied to porous material in the form of a spray, either from revolving sprinklers or nozzles set in satisfactory piping. If need be, sprinkling filters in cold weather can be operated as contact beds. The fact that spraying devices (sprinkling nozzles) did not freeze up at Columbus during the past winter is perhaps

the most surprising feature to those who then visited the Columbus sewage testing station. This being so, it seems safe to say that with sprinkling filters rates of filtration several times as great as with contact beds may be used; that is, rates in the neighborhood of 2,000,000 gallons an acre daily. In some instances, this advantage of sprinkling filters can not be readily utilized, owing to inability to secure sufficient head for their operation without resorting to pumping.

The effluent of these coarse-grained filters, while non-putrescible, is not so free from bacteria as effluents of sand filters, and they are quite turbid. Much of this turbidity, however, can be removed by sedimentation for a few hours.

Clogging is a more or less serious factor in all filter beds for sewage treatment; in the sand filter, clogging material accumulates in small quantities year after year, and it appears that ultimately there is needed to be scraped a portion of the upper surface of the sand layer. Present indications are that coarse-grained filters, receiving a partially clarified sewage, will require the entire filtering material to be cleaned once say in from three to five years, or oftener, if excessively high rates of filtration are employed.

Generally speaking, the removal of suspended matter from the sewage before filtration is an economy, enabling higher rates of filtration to be used.

Chemical precipitation is not now adopted for new projects, owing to the expense both of chemicals and sludge disposal.

Septic treatment ordinarily is helpful, as it causes from 50 to 70 per cent. of the sludge to be deposited by subsidence. Of this deposited sludge about one-half can usually be disposed of by bacterial action. The tanks ought to hold at least from eight to ten hours' average flow. Covers generally do not assist septic action in proportion to their cost. With an adequate design and skillful regulation, objectionable odors need not be feared with ordinary sewages.

Where septic treatment is applied to domestic sewages, available evidence indicates that several years may elapse between periods of cleaning out the sludge. Where street washings and trade wastes enter the sewers, septic tanks may require cleaning once a year or oftener.

SEWAGE POLLUTION OF OYSTERS AND OTHER SHELLFISH.

Evidence from various sources indicates that sewage pollution of shellfish needs correction in many places, both for the welfare of the public health and for the interests of the oyster industry, which suffers from "oyster scares." Means for suitable regulation and control are a live topic for discussion among sanitarians.

When sewage comes from a small community and affects large shellfish interests, it seems reasonable to provide for adequate purification of the sewage. When the shellfish interests are small and the expense of sewage purification would be relatively great, it seems logical to remove the shellfish. Intermediate conditions require different treatment, depending on various local conditions, which is also true of a large number of sewage disposal problems.

DISCUSSION.

DR. N. K. FOSTER, Sacramento, Cal., said that the question of water supplies and sewage purification to a person who is directly interested in public health is paramount to any other question. More preventable diseases can be traced to the water supply, and indirectly to the want of sewage purification, than to any other causes, barring, possibly, tuberculosis. The destruction of sewage in our state, California, comes more under

the health authorities than the water supply. Unfortunately, the health authorities have nothing to do with that except to keep streams from being polluted. Any municipality can take their water as they see fit, or allow any private corporation to do it without any permission from the health authorities. That is an unfortunate condition, which Dr. Foster hopes sometime to see remedied. The same condition exists in a good many of the Western states. In the protection of streams the health authorities have considerable power, and in this work, bearing directly on the health as it does, more can be done than in any other direction. The protection of streams from sewage appeals directly to physicians and health officers, because they know that the typhoid rate is something alarming all through this country. If not a quarter of the typhoid cases are reported, as has been stated, and nearly all will admit that a large proportion are not, what a terrible condition there is, with the large number of deaths that result and the amount of suffering that pertains to that one disease, a disease which is absolutely caused by the carelessness and want of information of the people. In a recent inspection of one of the principal rivers in California, Dr. Foster found everything going into the stream, and when he brought to the attention of the authorities the fact that they were throwing their sewage into the stream from which others were drinking below, some of them felt that he was interfering with their personal rights. One man remarked that the streams were made for sewers, although that town was taking water out of the stream farther up and throwing their sewage back into the stream, where the neighboring towns below took it out. It is a question that ought to have prompt attention, and the health authorities should be given the power to control absolutely the disposal of sewage and also the water supply. The use of copper sulphate is another question that is of great interest. Dr. Foster is a little fearful of it unless it is under good control. A company in California is working on that system, and claims to be able to purify any reservoir. In one reservoir it is reported that the water is coming through colored. The copper may kill some germs and the algae, but algae are not the worst thing in water. If water is going to be poisoned with sulphate of copper, Dr. Foster asked if it is an improvement on the germs. The bacterial count in water treated with copper is certainly very low, probably a good deal lower than in most cities in the United States, but the gas-producing germs are still there, showing contamination. Whether or not the typhoid germs are there can not be determined, but Dr. Foster believes that they are. He thinks that physicians should go a little slow before giving full sanction to the copper sulphate method of treating water, and have it studied a little more. If irresponsible companies are promising to do these things and pointing to a scientific body of men as authority for it, it will lead to untold trouble.

DR. M. L. PRICE, Baltimore, said that the effects of copper in small repeated doses have never been properly investigated. It may be of interest to those not acquainted with the fact that the oxygen-bearing pigment of the lobster's blood, corresponding to the hemoglobin of most animals and the chlorophyll of plants, is a copper instead of an iron salt. The modern sand filter beds for municipal water supply, and the contact and trickling beds for the disposal of sewage, mentioned by Mr. Fuller, are illustrated in the hygienic exhibit of the Massachusetts State Board of Health. All these methods of water supply and sewage disposal have been subjected to tests at the Lawrence Experimental Station, of which there is a model in the exhibit of the Section. Dr. Price said that he would be glad to demonstrate this exhibit to any one interested in water supply or sewage disposal.

DR. C. V. GENOWAY, Spokane, said that in Spokane there is some trouble about sewage, and he wished to ask for information. The authorities in Spokane are about to spend about half a million dollars on water-works, and he has been asking them to pay some attention to the question of filtration. It has been talked of, but nothing has been done so far. They seem to think that the water is good enough without filtration, but the Spokane Valley above Spokane is becoming very thickly settled, and in the course of five years the river banks

from Spokane to Coeur D'Alene City, about 30 miles, will be a continual town, and unless something is done now, some day there will be a frightful loss of life in Spokane. The new mayor, elected two weeks ago, has partly promised to listen on the subject of filtration. Dr. Genoway said that he knows little about filtration, but he wants to learn something about it, and to get what available literature he can on that line to show to the Spokane officials. When he went in office as health officer there were a large number of wells throughout the city. The water was cooler than the river water, that being the excuse people had for using the well. He looked up the records and found that typhoid fever had been prevalent, and on tracing it back he has found that at least 65 per cent. of the cases were caused by drinking well water; therefore, he is closing up the wells as rapidly as he can and compelling people to use river water. The sewage system in Spokane is not very satisfactory; that is, sewers empty into the river above the city and all through the city. Spokane started as a little town, and wherever the people found a convenient place to run the sewer water into the river they did so, and that Dr. Genoway is trying to have changed.

DR. DENSLOW LEWIS, Chicago, said in regard to conditions in Chicago that extensive bacteriologic determinations have been made by certain health officials of Illinois, with the result that the water supply of St. Louis is found to be improved. Now, there is an explanation, which is probably true. The increased volume of water going into the Mississippi since the construction of the drainage canal has diluted the sewage, favored oxidation, and, by increasing the flow of the river, has tended to lessen or to destroy bacteria. At all events, the statement has been made, and Dr. Lewis believes that it is true, that the water in the Mississippi at St. Louis is really better now than it was before the construction of the drainage canal in Chicago. The matter of first importance is to have a pure and adequate supply. All cities can not, like Portland, have snow-clad mountains in their vicinity, nor can they all have spring water, but the endeavor should be made to have the supply pure and to have it adequate. Failing in that, the next thing is to see that the water is purified one way or another, as is now done in many cities. Dr. Lewis was surprised at the statement that in Columbus, Ohio, the first attempt at public filtration had been made, as he had always understood that Philadelphia had a public filtration plant which had proved very successful. In Chicago, the work is not yet done. The drainage canal is completed, but still many sewers empty into the lake. There has been under construction for years a system of intersecting sewers, the idea being to have all the sewage from the city flow into the intersecting sewers, to be finally emptied into the drainage canal. As a matter of fact, some localities drain into the lake. At one fashionable hotel on the lake, where the bathing facilities are extensively advertised, a hotel that has become a resort of southerners during the summer, the sewage enters one street and the beach is just around the corner. In that hotel there are usually victims of typhoid; Dr. Lewis was one of them last January. Although the water is not supposed to be used for drinking purposes, it is used in the kitchen and for bathing, and it is easily understood how infection may occur. In Chicago, and it is an important factor to be recommended in every community, publicity is advocated regarding the actual condition of the water. When the intake is contaminated, as occurs at different times, the fact is announced in the newspapers, and the people are advised to boil the water. Of course, boiling the water is not all sufficient, but publicity is a step in the right direction, for it notifies the public regarding the actual condition of the water supply.

DR. E. A. PIERCE, Salem, Ore., said that two years ago in one of the meetings of the State Board of Health it was decided to look over the water supply of the different institutions of the state. Dr. Pierce's residence being in the Willamette Valley, he made an effort to inspect the water supply on that region. In Salem there was a mild epidemic of typhoid which started in Stayton, about 12 miles north of Salem. The sewage from one or two infected families was drained into a small creek which runs through Salem. The contaminated

water infected several people living at Turner, a few miles below. Later the reform school was in turn infected, though the pupils were forbidden to use the water for drinking; some of them did so and a number of cases appeared. In the penitentiary, where the water was used for bathing and for toilet purposes, there were a number of cases, and in the insane asylum, which also used the water, a number of patients were infected. A large number of samples of water were collected, and it was found that they were infected, and also that a large number of surface wells near the creek were contaminated. Despite all efforts along the creek and in the suburbs, the health officials were seriously handicapped on account of lack of an adequate sewerage system. After a time Mill Creek purified itself, and, after a few deaths, and a large number of mild cases, the condition of affairs was greatly improved. The city supply of water was overhauled. This is taken from the Willamette River, after passing through a large gravel screen, and, at the present time, it is apparently free from contamination. Of course, the use of Mill Creek water in the institutions has been abandoned, and the city is now as healthy as any. In the treatment of sewage in the suburban districts and in the outlying portion of the city, where there were no sewers, the septic tank system was adopted, as far as possible, and that method has been a great help. At the asylum farm, 6 miles northeast of the city, there is one septic tank which is accommodating the night soil of sixty patients. It has been inspected regularly since it was built two years ago, and is working splendidly. A large amount of waste is passing through it, and at the last examination the sludge at the bottom of the tank was scarcely perceptible, although it has never been removed. The scum on top of the fluid is six or eight inches deep, and the effluent is clear and not objectionable, the effluent passing into an open ditch. Dr. Pierce has one of these tanks at his home and it is working well. There is a large tank at the Chemawa Indian Training School, which is giving excellent satisfaction. Formerly the sewage of the institution of about 600 pupils and teachers was conveyed through open ditches a long way off across the field toward the river, and there was much annoyance and complaint regarding the bad odor arising therefrom. With the adoption of the septic tank, the condition has been entirely relieved, the effluent passing along the same ditch. The health officials instituted an investigation of the different institutions and towns along the Willamette River and streams tributary. These are more or less contaminated with sewage all the time. Oregon City established a filter, the water being taken from the river. The bacteriologic count of the water after having been treated by the filter, as compared with Bull Run water at Portland, is almost equal to it. It is hoped later to have the same plan adopted in other cities in the state. Mill Creek at Salem has apparently purified itself, but it is only a question of time, of course, when it may become contaminated again. Dr. Pierce declared that inland water ways should be protected against contamination by sewage, and the streams should be allowed to return to their virgin purity. He believes that the septic tank should be adopted for the treatment of sewage wherever the sewer can not be used, and in all suburban localities. Even in the large towns and cities he thinks that the same plan can be employed. The sewage farming plan as practiced largely in Europe has given excellent results. In reply to a question he described the tank at the asylum farm. It is ten feet long, five feet wide and four feet deep (the depth below the level of the fluid). The sewage enters at a slight grade from the toilet, and there is a pipe with an elbow that carries it about eighteen inches below the surface of the tank. This prevents any disturbance of the surface. The outlet is at the other end of the tank, on an exact level with the inlet, and is submerged to the same depth. The tank is built of cement, and is covered with a cement or iron cover. Most of the tanks have been sealed as described, but the one at Chemawa is not sealed, but has a shingle roof over the entire tank and a large air space above it. This tank treats the sewage of 600 people, nature has sealed the surface with a scum which is tough and leathery, and so the air is entirely excluded. Dr. Pierce does not believe that it is necessary to seal the tank, as nature

makes that provision. The anaërobic bacteria thrive in the absence of light and air, hence the first thing nature does is to seal the tank. All, then, that is necessary is to protect it with a cover to prevent debris from falling into it. The tank at Chemawa is fifty feet long, fourteen and one-half feet wide, and four and one-half feet deep. There are two baffle boards, one about ten feet from either end and a wire in the center. A mistake was made in its construction, as it was not originally made for a septic tank, but was intended simply for a storage tank. The weir was too high and enough space was not left for the free passage of sewage over the weir. That, however, has been remedied. Mr. A. G. Strang, engineer at the State Insane Asylum, who has had experience in this line, says that he does not favor the weir or baffle boards. Dr. Pierce's object in advising the weir and baffle boards, particularly in large tanks, is to break the currents, and in all the tanks that he has been consulted about, he has had them put in and they have given perfect satisfaction. A tank to work properly should have sufficient water supply to fill and empty once in twenty-four hours, and should have a capacity of about thirty gallons to each person using it. There should not be any odor from the tank, for the reason that nature seals the tank, and the effluent should not be offensive. Dr. Pierce believes that the action of the aerobic bacteria on the effluent as it emerges into the air and sunlight completes the work that was begun in the closed chamber by the anaërobic bacteria. A sand or gravel filter could be attached with admirable results.

DR. H. G. BEYER, Washington, D. C., said that he has always been surprised at the slowness with which the septic tank system has grown into prominence. Prevention of disease begins with the soil. Filtering and boiling the water after first allowing it to become contaminated through contact with polluted soil seems to him like putting the cart before the horse. If the soil were not polluted this filtration might be unnecessary. Human excretions are the most serious causes of soil pollution. If the soil were kept from this pollution by a good system of septic tanks, or by a proper sewage system a great deal of disinfection, Dr. Beyer thinks, would be unnecessary. He does not think that it would be extravagant for every block in town to have a space set apart for a septic tank. In this way every house in a city might be sure of sending its sewage into this filter; it would then not make any difference whether or not a sewer leaked or whether the sewage flows through a regular sewer or is taken care of by the ground, the soil itself remains unpolluted. It seems to Dr. Beyer that this is a very much more effectual method of sewage disposal than any other he can think of, and it is for reasons such as these that the slowness of the growth of the septic tank idea in the prevention of the spread of infectious diseases, is to be deplored. Of course, at first health officials would have to proceed very carefully in doing away with the filtration or purification of water, and that the latter procedure should be incidental to the imperfect disposal of sewage. The west coast is fortunate in its water supply, but unfortunate in its sewage disposal. The soil in large sections is a loose surface soil with a subsoil of hard pan, which is really lava and is absolutely impermeable to water. Any drainage will follow the subsoil for miles, so that water may be taken at one point containing infection coming from a great distance.

MATERNAL SYPHILIS.*

GEO. S. WHITESIDE, M.D.

PORTLAND, ORE.

Hereditary syphilis may be a transmission of disease from the father alone or from the mother alone or from both together. Maternal syphilis may be defined as only the disease of the pregnant woman, but to-day we may also consider, briefly, its influence on her offspring as well.

Syphilis in the mother, without paternal disease, is

* Read in the Section on Obstetrics and Diseases of Women of the American Medical Association, at the Fifty-sixth Annual Session, July, 1905.