accessible to the swab, this would in the majority of cases exclude "true diphtheria," for the bacilli are disposed very superficially, and when transferred alive, readily grow in the artificial media used in the laboratory. As a matter of fact, the primary local lesion of this disease may occur in the trachea, the larynx, or in the cavities of the nose, not to mention other places, and in such cases a swab inoculation from the pharynx would only accidentally result in the transference of bacilli to the culture tube.

(To be continued.)

WATER CLOSETS FOR COTTAGE PROPERTY.*

BY

J. H. CROCKER, M.D., D.S.Sc., M.O.H. of Eccles.

IN connection with the water carriage system, the question, "Which is the best form of water closet

Ordinary Water Closets.—These are flushed with fresh water from a cistern holding about three gallons, the closet having a water seal.

Trough Closets, or Latrines.—These are of use where several closets are wanted in a row; they are flushed with fresh water by means of automatic syphons, action cisterns, or tipplers.

The Frost of Last Winter.—The cold period commenced on December 30th, 1894, and terminated in the third week of March, practically a continuous frost of about seventy days.

The severity is evident from the published results of records taken at the observatory of our adjoining borough, Salford; the mean temperature in January being 34·4 deg., which is 4·5 deg. below the average for that month, and in February 31·6 deg., or 8·3 below the average.*

The following shows the temperature in the shade for the first eleven weeks of the year:—

MONTH	...	...	...	...	...	JANUARY.				FEBRUARY.				MARCH.		
WEEK ENDING	...	...	...	...	...	5	12	19	26	2	9	16	23	2	9	16
MAXIMUM	...	...	...	...	...	42·2	39·2	44·2	42·8	38·6	39·4	40·0	42·5	45·8	48·1	55·1
MINIMUM	...	...	...	...	...	28·0	22·2	26·2	25·0	22·0	16·8	18·8	27·0	31·0	28·2	32·2

to advise in cottage property," often arises, not only in the case of new property, but also in that already in existence, there being many streets in this district laid out with a privy midden situated at the back of each house, and in the majority of cases about six feet from it.

The particulars given below concerning the water closets already existing in this class of property in the borough of Eccles, I trust, will be of some assistance in answering the above question.

Slop Closets.—By the term slop closet is meant one in which the waste water from the slop stone, etc., is used to flush the closet; in the majority of cases—and preferably—a tipper holding about three gallons is interposed between the slop stone pipe and the closet, as in Duckett's, etc., or in the closet, as in Day's.

It has been claimed for this class of closet, which is meant for out-of-door use only, that they act automatically, are inexpensive, not likely to get out of repair, provided they are systematically inspected, and that during periods of frost they do not give rise to any trouble. As a system it economises the water supply and diminishes the volume of sewage to be disposed of—an important condition when the sewage has to be pumped, as it has to be at our sewage farm.

Slop Closets.—There are over 280 of these in use in this district.

1. *Freezing.*—In no case was there any history of obstruction due to the frost.

2. *Tipper out of Order.*—In five cases the tipper had been out of order.

3. *Out of Order through Obstruction.*—Cause.—Of the 6 which have been fixed 6 months, 2 have been stopped owing to bricks thrown down.

Of the 13 which have been fixed 9 months, none have been stopped up.

Of the 5 which have been fixed 12 months, none have been stopped up.

Of the 5 which have been fixed 15 months, none have been stopped up.

Of the 62 which have been fixed 18 months, 7 have been stopped up:—

- 1 case the main drain was stopped.
- 4 were stopped with wood or sticks.
- 1 with rags.
- 1 with a tin can.

Of the 93 which have been fixed 2 years, 15 have been obstructed:—

- 5 cases main drain was stopped.
- 2 cases stopped with floor cloth.
- 5 cases stopped with wood or sticks.
- 1 case stopped with rags.
- 1 case stopped with a salmon tin.
- 1 case stopped with rags and paper.

* From a special report by the Medical Officer of Health to the Sanitary Committee of the Borough of Eccles.

* County Borough of Salford Health Bulletin, first quarter, 1895, by Dr. C. E. Paget, M.O.H.

Of the 19 which have been fixed $2\frac{1}{2}$ years, in 1 case the main drain was stopped.

Of the 57 which have been fixed 3 years, 9 have been obstructed:—

- 2 cases main drain stopped.
- 2 cases stopped with brushes.
- 1 case stopped with floor cloth.
- 1 case stopped with old bonnet.
- 3 cases stopped with rags.

Of the 14 which have been fixed 4 years there is no record of any obstruction.

Of the 12 which have been fixed an unknown time, 3 were obstructed:—

- 2 with sticks.
- 1 with rags.

Total, 284. Total obstructed, 37; or 13 per cent. Deducting stoppages of main drain, less than 10 per cent.

Several of these closets are amongst the lowest classes in the borough. It is a general experience that a larger proportion of closets are stopped up when first adapted in a town than is subsequently found, and in support of this is the fact that of those which have been fixed for four years the present tenants cannot remember any time when the closets were stopped up.

4. *Offensiveness.*—In several cases the closets were not clean. This is easily remedied by pouring down a bucket of clean water once a week.

ORDINARY WATER CLOSETS.

1. *Since when Adopted:*—

3 months	...	...	...	=	15
4, 5, and 6 months	...	...	...	=	30
7 and 8 months	...	...	...	=	10
9 months	...	...	...	=	11
12 months	...	...	...	=	13
14 and 15 months	...	...	...	=	7
18 months	...	...	...	=	66
2 years...	...	...	...	=	38
3 years...	...	...	...	=	13
4 years...	...	...	...	=	10
7 years...	...	...	...	=	4
12 years	...	...	...	=	2
15 years	...	...	...	=	4

Total 223

2. *Freezing.*—(a). *Cistern.* Particulars concerning freezing of the cistern during the last frost were obtained in 126 of above:—

Time frozen.	Number of cisterns.
Half a day	...
1 day	...
2 days	...
3 days	...
4 days	...
1 week	...
2 weeks	...
3 weeks	...
4 weeks	...
5 weeks	...
6 weeks	...
7 weeks	...
Total	...

3. *Water in Pan Frozen* = 21.

4. *Bursting of Service Pipe through Frost* = 34.

5. *Pan Cracked* = 6.

6. *Position of Closet.*—All built against the house excepting in 43 cases.

7. *Position of Cistern.*—All in the closet and not cased in, excepting in the following 46:—

In closet and cased over	=	1	No freezing.
In the house and not cased	=	18	" "
" " "	=	3	Main frozen.
" " "	=	1	Frozen 1 day.
" " "	=	1	" 2 days.
" " "	=	3	" 2 weeks.
" " "	=	1	" 3 "
" " "	=	1	" 4 "
In the house and cased in	=	13	No freezing.
" " "	=	1	Frozen 1 day.
" " "	=	1	" 2 days.
" " "	=	2	" 3 "

Total ... 46

8. *Obstruction in the Pan or Drain:*—

In 16 cases the main drain had been stopped.

In 1 case the pan had sunk out of place.

In 4 cases obstruction was due to neglect in flushing.

In 1 case the pan had been stopped up with tin can.

In 1 case the pan had been stopped up with floor cloth.

In 3 cases the pan had been stopped up with paper.

In 1 case the pan had been stopped up with brush.

Trough Closets, or Latrines.—At present there are two of these in the borough, and they work very satisfactorily. During the last frost there was no obstruction due to freezing.

Remarks.—In most of the cases where the main drains were stopped it was due to fine ashes, which had been carried in from drained privy middens.

From the point of cleanliness the ordinary water closet is preferable, and from the foregoing evidence if the closet is built against the house and the cistern placed inside in the kitchen or scullery and properly cased in, there is little fear of freezing. The closet should be of the short hopper, or wash-down type, with a good water seal, and the cistern should hold at least three gallons, and be of syphon action, one pull of the lever ensuring complete emptying; the supply pipe should be at least of $1\frac{1}{2}$ inches calibre.

In dealing with those cases where the closet is situated away from the house, or where the class of tenant is unfortunately ignorant, careless, negligent, or destructive, the slop closet is decidedly preferable.

In Nottingham*, where they are about to enter upon a wholesale conversion of pails into the water carriage system, they have decided to put ordinary water closets in all houses of more than £18 annual rental value, and slop closets in those of a lower rental.

In the case of the few blocks of closets in our district, and also for mills and schools, the trough

* PUBLIC HEALTH, May, 1895.

closet or latrines, where the contained water is a foot below the ground level, is to be recommended.

A regular inspection of the closets in this class of property should be made by the sanitary inspector to ensure cleanliness and avoid neglect, and the keys for the regulation of the fresh water supply to the latrines should be under his charge.

RECENT RESEARCH.

The Microscopical Counting of Plates, and Its Special Use in the Counting of Water Plates.
By Dr. Max Neisser. *Zeitschrift für Hygiene*. Vol. XX., p. 119.

THE author begins his article by referring to the fact that the counting of plates is the only means used for ascertaining irregularities in the working of sand filter beds. The methods of counting have not altered much in the course of years. Usually a definite quantity of the fluid to be examined is taken, mixed with gelatine, and poured on to a plate or Petri dish. When the number of bacteria in the liquid is great, a definite quantity is taken and diluted with sterile water before it is mixed with the gelatine.

The counting has up till now usually been done with the naked eye, or with a magnifying glass, with the aid of Wolffhügel's counting apparatus. Buchner was one of the first to describe the method of counting the colonies upon a gelatine plate by the number appearing in a microscopical field of known size. Günther in his text-book recommends this method for plates that are thickly sown with colonies. The average number of microscopical fields counted would be from 10—20. In plates very thickly sown, an eye-piece provided with a micrometer would have to be used.

The object of the present paper is to show how far the microscopical counting of plates gives accurate results, and further, up to what maximum and minimum in the number of colonies can microscopical counting be employed, and, finally, how many microscopical fields should be counted as a rule to give an accurate average.

Experiments were made to determine these points in plates made from pure cultures, and also from mixed sources, as, for instance, water.

Amongst the objections to counting colonies with the magnifying glass are that very often the colonies cannot be seen, so small are they; they may be so close to others as to be indistinguishable from them; more than 20,000 colonies on a plate cannot be counted without introducing great errors in the calculations. Further, since plates but sparsely sown with colonies are best fitted for counting in this way in order to arrive at that result, dilutions are made which tend to introduce other sources of error, as the total number found is multiplied by the factor of dilution.

Experiments were made by (1) comparing the

result of counting plates with the hand lens and with the microscope; (2) comparing the numbers found in different plates which had been inoculated with definite known quantities of a pure culture; and (3) several microscopical countings of the same plate were made on different days with the view of finding out whether the results harmonised sufficiently with one another.

The conclusions are:—

(1) In pure cultures with 1,500 or more colonies to a plate, the microscopical counting is decidedly to be preferred to that of the hand lens. When 30 microscopical fields are counted, the error does not exceed $+\frac{1}{7}$ th or $-\frac{1}{8}$ th.

(2) In pure cultures, when the number of colonies varies between 600 and 1,500, the errors of the microscopical method of counting are greater, and may, when 60 fields are counted, be as high as $+\frac{1}{3}$ rd or $-\frac{1}{4}$ th. But in these cases the errors from counting with the hand lens may be even greater.

(3) In pure cultures where the colonies number 300—600, when 90 fields are counted, the error may be as much as $+\frac{1}{2}$. Counting with a hand lens gives similar results.

(4) Where less than 150 colonies occur, the microscopical method is not indicated.

(5) All these errors are diminished by increasing the number of microscopical fields counted.

(6) In quantitative experiments, for the sake of accuracy, it is not advisable to carry dilutions so far that such low numbers are obtained.

(7) Mixed plates (*i.e.*, those not made from pure cultures) should always be counted by means of the microscope, because of the presence usually of small colonies.

(8) Whether the results obtained by counting with the hand lens give an accurate measure of the number of bacteria in water has still to be proved.

(9) If it is necessary to count a plate by means of a hand lens, then it should always be subjected to a microscopical examination first to see whether it is suited to the first-named method.

(10) In every counting it should be stated whether it was done with the hand lens or microscope, and after how many hours. In every microscopical counting, the size of the field should be given, and especially the number of separate fields that were counted.

Bacteriologische Studien über Margarin und Margarinproducte. By Drs. Jolles and Winkler. *Zeitschrift für Hygiene*. Vol. XX., p. 60.

The experiments were undertaken with the view of seeing whether the same conditions hold good for margarine as are found in butter. Butter contains on the average an enormous number of bacteria (10—20 millions in 1 gram.). There can be no question that inflammations of the mucous