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BACTERIA in the DUST of ROOMS.

I. Introduction.

(a) - Presence of bacteria in dust.

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II. Discussion - bacteria in the dust of rooms.

(a) - Harboring of bacteria in carpets of

1. Private houses.

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1. Bare floors.

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1. Bacteria found in dust after sweeping.

(1) Bare floors.

(2) Oiled floors.

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2. Bacteria found in dust after various ways of sweeping.

3. Bacteria found in dust after various ways of dusting.

(1) Feather duster.

(2) Moist cloth.

4. Number of bacteria found in a still room.

5. Number found after a shower.

III. Conclusion.

1. Bacterial origin of the infectious diseases.

2. Cleanliness.

Bacteria are found every-where in nature, except at very high altitudes and at great depths. Among these various places, the dust of the air contains a great number of these minute microscopic organizations. Furthermore, these micro-organisms are very apt to be found clinging singly or in clusters to the larger or smaller particles of one kind or another, which usually make up the bulk of visible or invisible dust in inhabited regions.

It is well known that there are certain occupations which confine persons to closed rooms or places in which dust particles of one kind or another are very abundant. Thus day after day, persons confined in air charged with coal-dust, metallic dust, cotton, woolen, or tobacco dust, are subject to attacks of more or less well marked pulmonary affections.

There are three prominent forms of the living elements of dust, or the minute vegetable organisms, called bacteria, yeasts, and molds. Among these, the bacteria are far the most important; most of them being harmless to man and serving a very important purpose in the economy of nature in tearing asunder dead and worn out organic material and setting it free in suitable condition for the building up of new forms of life. A few species of bacteria however, are capable of causing some of the most wide-spread and dreaded of human diseases.

The atmosphere is never entirely free from dust and bacteria, but there are times when the number is greatly reduced. As the conditions of warmth and moisture favor the growth of bacteria, it might well be supposed that during the summer there are greater numbers present than in the winter months. And this is the case; during the

late spring and summer, there are several times as many bacteria present in the air, both in doors and out. Besides the favorable warmth and moisture of these seasons, there is the additional advantage of a great amount of decaying matter present, both vegetable and animal. Then, too, there are periods of the same season where the numbers of bacteria in the atmosphere are greatly diminished or increased. Immediately after a shower, the air is cleansed and freed from a large number. This condition remains so long as the bacteria are moist.

That dry air and dry ground surfaces and winds favor the distribution of dust, and that still air and moist ground tend to hold it in check, are facts which every one's observation teaches. Therefore we would expect a greatly increased number of bacteria present in the air on an exceedingly warm and windy day. A high wind blowing across a region rich in dry, pulverized germ laden material, will for a time disseminate large numbers of micro-organisms; but at the same time, it tends, by the dilution which it affords, and by the carrying them off to other regions, to speedily reduce the number in any given place.

Thus we see the dust furnishes a very good means of transporting bacteria. As has been previously stated, the majority of germs are non-pathogenic to man, but there are some which cause severe and wide-spread diseases among men, for example, consumption, measles, and others, some causing a variety of diseases among the lower animals. The confined air of infected places can become the carrier of diseases either by depositing those germs upon alimentary matter, or on the surface of wounds, or by transporting them into the respiratory passages.

It is not necessary that the germs thrive and multiply in

the air, but the dust may only serve as a resting place for them, but when taken into the body, they may begin a rapid growth and soon cause a well developed disease. This is the case with the germ of consumption, the Bacillus Tuberculosis; it does not grow in nature, so well, outside of the bodies of men and a few species of warm-blooded animals. It may, however, remain alive for a long time, in the soil or air. Fortunately the safe guards of the body against inhaled germs are constantly in action, and in a large degree, in many persons, actually and wholly protect against danger, even in dirty and infectious places.

Many disease producing bacteria soon die and in greater or less numbers, soon after they are expelled from the bodies of sick persons, many are swept away by the winds into uninhabited regions; many fail to come into contact under favorable conditions with susceptible beings. But these natural safe guards cannot be implicitly relied upon for safety at all times. It is certain that in the out of doors air, in the country, and also in the cities whose streets are kept decently clean, there is little danger of harm from the inhalation of germs of some diseases, because the purifying agency of wind and air currents will either soon sweep away the dust or so largely dilute it that it will be practically free from disease germs. On the whole, the risk of infection from out of doors dust, even in crowded towns, unless they are notably filthy, is not actually very great.

Indoors, however, the conditions are entirely different. Here, as elsewhere, the sources of micro-organisms are various. They may be brought in on the feet and garments from the streets or other places, or be blown in through open windows and doors, or drawn in by other modes of ventilation. It is perfectly obvious that unless

the windows be widely open or liberal air currents in some way established, the too common methods of so-called dusting - that is, the stirring up of the dust which has settled on the smooth places in a room so as to allow it to settle again on the rough surfaces and inconspicuous places where it does not show - is worse than useless, since the dust and the germs are not in this way destroyed but only redistributed and put for a time in a situation suitable for inhalation. Carpets and heavy hangings and upholstery with rough goods, all insure the more or less persistent retention of dust particles in rooms and with these, the harmful germs, if such be present. Carpets which are tacked down to the floor, are very seldom taken up more than twice during the year, and they afford an excellent harboring place for bacteria, both in the carpet and under it. The old fashioned chairs and couches with their rich and heavy upholstery, furnished another good resting place for numbers of bacteria. Fortunately, the greatest number of chairs and almost all furniture of the latest manufacture, is of the simplest style with smooth polished bottoms, backs and arms.

Hard floors, with rugs, which may be cleaned out of doors, as few and as light hangings as are practicable, no upholstered furniture, or upholstered as far as may be with smooth surfaced fabrics, the use of moist dusting cloths, and the wide opening of windows and doors when cleaning is going on, - these are the general suggestions, which, if followed, will confer in a large degree, even in populous towns, a sense of security against the dangers of dust in private houses in which healthy persons live.

In houses and larger buildings which are supplied with a system of forced ventilation, or where ever the ventilation draught

is strong enough, a great deal may be accomplished in the way of keeping the dust out of the buildings by the use of cheese cloth or thin cotton batting screens placed across the air currents near the entrance of the ventilator shafts.

A class of buildings in which the bacteria of dust is a matter for very serious consideration, is that of churches, schools, theaters and other places where large numbers of persons are frequently crowded together. Here the individual, in the matter of cleanliness of the air he breathes, is largely at the mercy of his fellows, and especially of the persons too often ignorant and careless to whom is intrusted the more or less frequent sweeping, dusting, or other cleaning of the rooms. The ventilation of many of the theaters is usually inadequate, even for the purpose of carrying off the vitiated air of respiration, and is of almost no use in freeing the air of dust. Close walled they are apt to be, so that large volumes of outdoor air rarely and perhaps never sweep through them, carpeted and the chairs upholstered in plush, visited by large numbers of all kinds of people who, in the long sittings are very liable to thoroughly their shoes on the carpets and leave other wastes behind them. The floating particles accumulated in theaters in enormous quantities, and it is a fact that in most theaters ~~there~~^{there} is no efficient means made use of to get out this accumulating dust. The coarse dirt is swept up and carried off, but the finer dust is simply stirred up again from the seats to settle back into the plush or carpets, to be distributed anew by the incoming and out-going audience. The fact is, the upholstering of the chairs of the public also, ought never to be done with plush or other rough fabric which catches and holds the dust. The floors should not be carpeted, as there are plenty of other whole-

some substitutes, and both the ventilation and daily cleaning should be done under some intelligent instructions.

This matter of enforcing reasonable cleanliness in places of assembly, rests, as all other matters of sanitary reform ultimately do, with the people themselves. So long as the patrons of filthy theaters permit themselves to remain the victims of ignorance or carelessness, the managers of theaters will doubtless continue to do just as they have been doing, no matter what in their practices is shown to be dangerous.

Public conveyances into which, especially in this country, people are crowded indiscriminately, are very rarely properly cleaned and dusted. Of course, in these it is not the ordinary inorganic dust which is most to be dreaded, but the material which came from uncleanly travelers who are the victims of some bacterial disease.

The dust of ordinarily clean public rooms and of private houses is not, as we know, dangerous or especially harmful unless it has among its ingredients, the living germs which have come from the bodies of persons suffering from a bacterial disease.

The end to be accomplished, then, in housekeeping, is the removal and not the simple redistribution of the dust. There are two important means of getting rid of dust, either in private houses or in places of public assembly. The first is to sweep and to stir up the dust with the windows and doors wide open so that the temporarily floating particles may be largely carried out of doors, where they will be soon diluted and swept off. It should, in the second place, be borne in mind that in still rooms the dust, and with it the larger part of the aeral germs, will settle, within a few hours, so as to leave the room with a comparatively small number of bacteria in the air. If, now, the mopping of the floor or the dusting of furniture

with moist cloths be practiced, the larger part of the dust may be completely removed from the rooms. The completeness of this removal will, of course, depend largely upon the simplicity of the furnishing and the intelligence which is used in the work. If the regulation of the work of dusting and sweeping rooms is left to ignorant and careless servants, without intelligent and persistent supervision, it cannot be expected to result in clean living places.

It may be well to call attention in the briefest way to many devices in reach of the enlightened housekeeper for cleaning carpeted floors without raising clouds of dust. Such practices as the sprinkling of carpets with coarse salt, or salt and bran, moist tea leaves, or other substances which keep down dust, the use of some of the more perfect forms of patent carpet sweepers and other devices, may be brought to bear in solving the problem of clean living.

The following data are from experiments made by the writer. Exposures were made on agar plates; petri dishes four inches in diameter were used. The bacteria were grown on sets of media which consisted of milk, litmus milk, potatoes, bouillon, agar, and gelatin. The exposures were made in a residence of ten rooms and occupied by a family of five. All exposures were made in living rooms and the plates were placed on a chair in the middle of the room. The exposures were all made in the day time and the house was comparatively new, having been occupied but six months.

I. After sweeping carpeted floors with a broom.

Time of Exposure - Length of growth - Number of colonies.

A - 15 sec.	- - -	-Growth 20 hrs.	- - - - -	-2	Kinds -2.
B - 30 sec.	- - - -	" 20 "	- - - - -	6	" - 2
C - 1 min.	- - - -	" 20 "	- - - - -	1	" - 1

Data Continued.

Time of exposure.	Length of growth	Number of colonies.
A - 15 sec. - - - - -	-Growth 44 hrs.- - -	1590 Kinds - 2
B - 30 sec. - - - - -	" 44 " - - -	3220 " - 3
C - 1 min. - - - - -	" 44 " - - -	5096 " - 4

II - After sweeping an oiled floor.

Time of exposure.	Length of growth	Number of colonies.
D - 15 sec. - - - - -	growth - 20 hrs. - - -	-1 kinds - 1
E - 30 sec. - - - - -	" - 20 " - - -	-14 " - 1
F - 1 min. - - - - -	" - 20 " - - -	33 " - 1
D - 15 sec. - - - - -	" - 43 " - - -	-916 " - 2
E - 30 sec. - - - - -	" 43 " - - -	1,673 " - 1
F - 1 min. - - - - -	" - 43 " - - -	2,453 " - 1

III - After sweeping a carpeted room with a carpet sweeper.

G - 15 sec.	- Growth 18 hrs.	- Colonies, 1 - Kinds 1.
H - 30 sec.	- " 18 " - " 4 - " 2.	
I - 30 sec.	- " 18 " - " 6 - " 1	
G - 15 sec.	- " 30 " - " 196 - " 1	
H - 30 sec.	- " 30 " - " 237 - " 2	
I - 1 min.	- " 30 " - " 400 - " 1	

IV - After dusting with a feather duster.

J - 15.	- Growth 20 hrs.	- No. of colonies 1 - Kinds 1.
K - 30 sec.	- " 20 hrs.	- No. " " 1 - " 1.
L - 60 sec.	- " 20 hrs.	- " " " 3 - " 3.
J - 15 sec.	- " 34 hrs.	- " " " 75 - " 1.
K - 30 sec.	- " 34 hrs	- " " " 92 - " 1.
L - 60 sec.	- " 34 hrs.	- " " " 125 - " 3.

V - After dusting the above room with a slightly dampened cloth.

M - 15 sec. - Growth 18 hrs. - Colonies 0 - Kind - 0.
N - 30 sec. - Growth 18 hrs. - Colonies 1 - Kinds - 1.
O - 60 sec. - Growth 18 hrs. - Colonies 3 - Kinds 1.
M - 15 sec. - Growth 34 hrs. - Colonies 20 - Kinds 1.
N - 30 sec. - Growth 34 hrs. - Colonies 54 - Kinds 2.
O - 60 sec. - Growth 34 hrs. - Colonies 75 - Kinds 1.

VI - After sweeping a bare floor.

P - 15 sec. - Growth 18 hrs. - Colonies 2 - Kinds 1.
Q - 30 sec. - Growth 18 hrs. - Colonies 20 - Kinds 1.
R - 60 sec. - Growth 18 hrs. - Colonies 24 - Kinds 2.
P - 15 sec. - Growth 30 hrs - Colonies 537 - Kinds 1.
Q - 30 sec. - Growth 30 hrs. - Colonies 985 - Kinds 1.
R - 60 sec. - Growth 30 hrs. - Colonies 1760 - Kinds 2.

VII - Before sweeping bare floor.

S - 15 sec. - Growth 20 hrs. - Colonies - 0 - Kinds 0.
T - 30 sec. - Growth 20 hrs. - Colonies - 1 - Kinds 1
U - 60 sec. - Growth 20 hrs. : Colonies - 2 - Kinds 1.
S - 15 sec. - Growth 40 hrs. - Colonies - 0 - Kinds 0 .
T - 30 sec. - Growth 40 hrs. - Colonies - 4 - Kinds 1.
U - 60 sec. - Growth 40 hrs. - Colonies -11 - Kinds 1.

VIII - After sweeping when salt was sprinkled on the carpet.

V - 15 sec. - Growth 18 hrs. - Colonies 1 - Kinds 1.
W - 30 sec. - Growth 18 hrs. - Colonies 1 - Kinds 1.
X - 60 sec. - Growth 18 hrs. - Colonies 4 - Kinds 1.-
V - 15 sec. - Growth 40 hrs. - Colonies 4 - Kinds 1.
W - 30 sec. - Growth 40 hrs. - Colonies 7 - Kinds 2.
X - 60 sec. - Growth 40 hrs. - Colonies 11 - Kinds 1.

IX - In above room, immediately after a shower.

Y - 15 sec. - Growth 18 hrs. - Colonies 1 - Kinds 1.

Z - 30 sec. - Growth 18 hrs. - Colonies 2 - Kinds 1.

& - 60 sec. - Growth 18 hrs - Colonies 1 - Kinds 1.

Y - 15 sec. - Growth 40 hrs - Colonies 8 - Kinds 1.

Z - 30 sec. - Growth 40 hrs. - Colonies 7 - Kinds 1.

& - 60 sec. - Growth 40 hrs - Colonies 12 - Kinds 1.

Growths of the several colonies on sets of media.

Cultural characteristics.

A - 1. *Bacterium ambiguum*.

Agar - slimy moist growth, very thin.

Bouillon - clouded.

Gelatin - liquefied with white round colonies on surface.

Potato - Creamy growth.

Litmus milk - watery.

A - 2. *Bacillus Subtilis*.

Agar - grayish, thick, wrinkled colonies.

Potato - velvety wrinkled growth of a grayish brown color.

Gelatin - white growth on surface and liquefied along line of inoculation.

Bouillon - White, thin, filmy skum on top.

Milk - Coagulated.

Litmus milk - Coagulated and turned white.

B - 1. *Bacillus Subtilis*.

Agar - grayish white, thick wrinkled growth.

Bouillon - White filmy growth.

Milk - Coagulated.

B - 2. *Micrococcus pyogenes*.

Agar - yellowish gray spots.

Bouillon - white sediment and clouded.

Potato - abundant white growth.

Milk - Coagulated.

Litmus milk - liquefied and cloudy, with sediment.

B - 3. *Micrococcus foetidus*.

Gelatin - liquefies slowly; white shiny growth.

Agar - White irregular growth.

Potato - irregular shiny growth with a reddish tinge.

Bouillon - white filmy growth on top.

Milk - coagulated.

Litmus milk - coagulated.

C - 1. *Micrococcus pyogenes*.

Agar - yellowish gray spots.

Bouillon - white sediment and clouded.

Potato - white thick growth.

Milk - coagulated.

Litmus milk - coagulated.

Gelatin - liquefied and cloudy with sediment.

C - 2. *Bacillus Subtilis*.

Bouillon - white, thin filmy growth.

Agar - grayish white wrinkled growth.

Milk - coagulated.

Litmus milk - coagulated and changed color to white.

Potato - velvety, thick, wrinkled growth of a dirty white color.

Gelatin - liquefied along line of inoculation.

C - 3. *Sarcina Auranticea*.

Gelatin - liquefied along line of inoculation.

Agar - orange colored growth.

Potato - thick growth of an orange color.

Milk - coagulated.

Litmus milk - coagulated; acid reaction.

Bouillon - clear and a heavy sediment.

D 1- Growth same as A - 2.

D - 2 Growth same as C - 3.

E - 1 Growth same as C - 1.

F - 1 growth same as B - 3.

F - 2 growth same as B - 2.

C - 1 growth same as C - 1.

H - 2 growth same as B - 3.

H - 1 growth same as B - 1.

I - 1 growth same as B - 2.

J - 1 growth same as A - 2.

K - 1 growth same as B - 3.

L - 1 growth same as C - 1.

L - 2 growth same as B - 2.

L - 3 growth same as B - 1.

M - 1 growth same as B - 1.

N - 1 growth same as A - 2.

N - 2 growth same as B - 1.

O - 1 growth same as C - 1.

P - 1 growth same as C - 3.

Q - 1 growth same as B - 3

R - 1 growth same as A - 2.

R - 2 *Bacillus Rapaus*.

R - 2. *Bacillus Rugosus*.

Gelatin - thin colorless growth on surface.

Potato - thick yellowish white growth.

Bouillon - clouded and a sediment.

Milk - changed to a dark color.

Litmus milk - same as milk, with a disagreeable odor.

Agar - white raised growth.

S - 1 same as B - 3.

T - 1 same as A - 2.

U - 1 same as C - 3.

W - 1 same as C - 2.

X - 1 same as B - 1.

Y - 1 same as B - 2.

Z - 1 same as C - 3.

& - 1 same as R - 2.

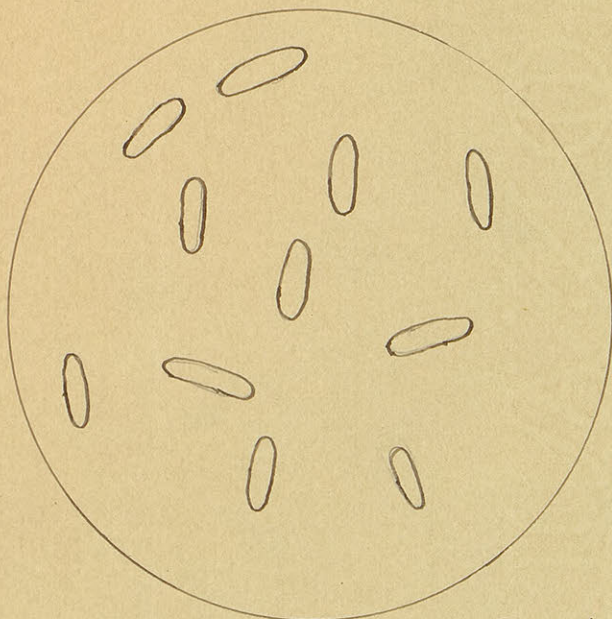
We are just entering upon a new epoch in our knowledge of disease. The discovery of the bacterial origin of so many of the infectious diseases, which have here-to-fore been as mysterious as they were fatal, has placed us on a higher level. There is good hope, in the not distant future, that we may not only in a large degree limit the spread of these diseases, but even learn reliable means of cure for them.

It is because medical science is raising itself in the light of our new knowledge, that we are hearing so much these days about bacteria and germs and infection and the need of more intelligent cleanliness.

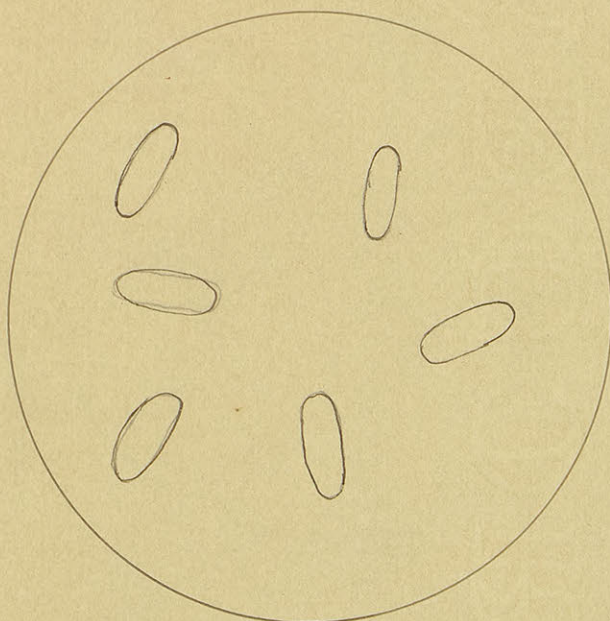
It is not a mere fashion nor the fad of the passing hour, which dictates the doctrine of cleanliness in person, food and air. If our research into the sources of widespread human ill does carry

us down into the invisible world, we bring from it such knowledge as is full of significance and rich in the promise of human prosperity.

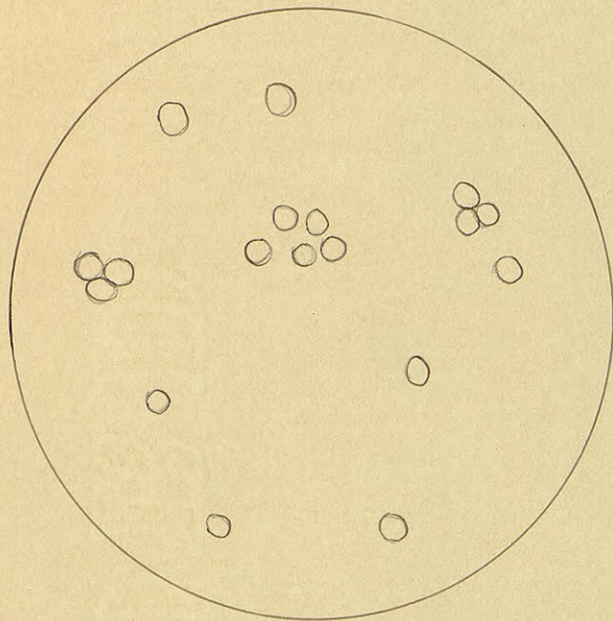
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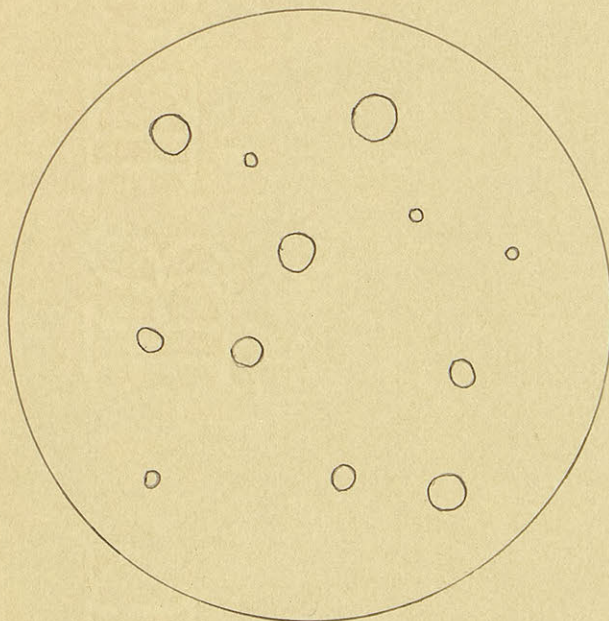
Bacillus ambigua.



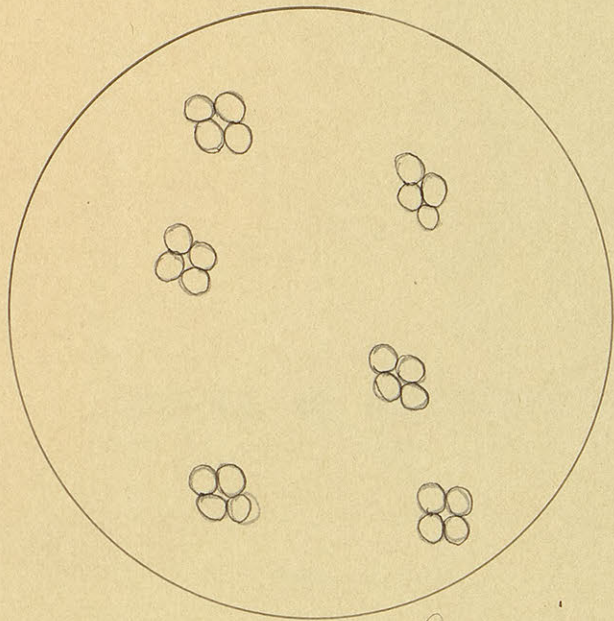
Bacillus subtilis



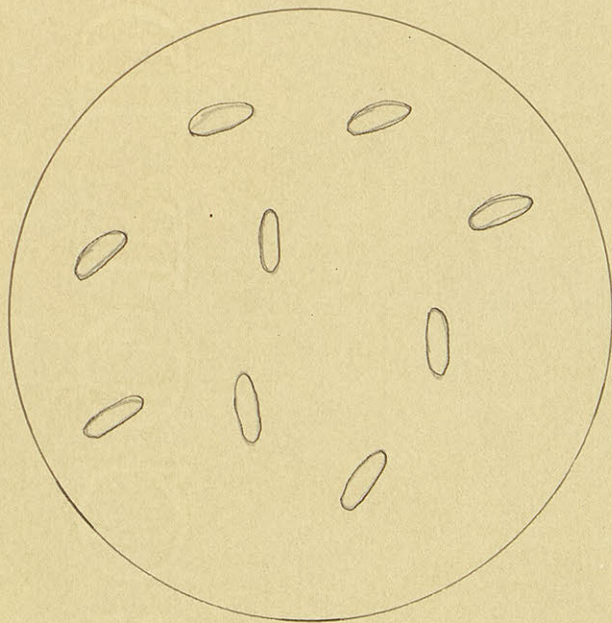
Micrococcus pyogenes.



Micrococcus foetidus.



Sarcina Aurantia.



Bacillus Rugosus.