

PYOGENIC BACTERIA.

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PY O G E N I C B A C T E R I A .

In earlier modern time it was supposed that in all pus formations there existed bacteria, and that these organisms were the cause of the pus formation, but by later experiments it has been proven that bacteria are not in all cases present.

Organisms which produce pus have been grouped by themselves and called pyogenic bacteria.

By experiments performed by Growety, DeBasy, Steinhaus, Kaufin and others it was conclusively proven that certain chemical substances injected beneath the skin give rise to pus formation without presence of bacteria.

Pasteur proved in 1878 that sterilized culture of pus cocci produced pus formation when injected subcutaneously. This fact has also been confirmed by a number of bacteriologists as regards various bacilli.

Buchner proved that the so-called pus forming property was due to the bacterial cells and not to any chemical production by the living cells. To prove this Buchner filtered a pus producing organism through a Chamberlain filter; the filtrate which passed through was of no effect when injected subcutaneously, but the dead bacterial cells retained by the filter produced aseptic pus. Buchner then made further experiments to prove the cause of pus formation and his conclusion was that it is due to the albuminous contents of the bacterial cells.

Though it has been conclusively proven that a large number of

micro-organisms may cause the formation of pus, the extended research of numerous prominent bacteriologists prove that but few species are concerned in the formation of abscesses and ulcers troublesome to man.

The two most important of these from the standpoint of frequency of occurrence and pathogenic power are, *Streptococcus pyogenes* and *Staphylococcus pyogenes aureus*, of the other species, *Micrococcus* is probably as frequently found as any and next in number of occurrence are numerous bacilli.

The number of species in an abscess varies, there being seldom but one and usually as many as six or more, but where there is a large number they are probably other than pus forming organisms.

The alkaline reaction and high specific gravity of pus make it an excellent medium for widely differing organisms.

A wound at some time of its existence contains germs, which are more or less pathogenic and the progress of the wound varies directly with the virulence of the germ. Roff and Ghsisky, two noted bacteriologists, have shown that under the most rigid antiseptic treatment, micro-organisms are found either attached to the bandage, stitches or in the wound made by the surgeon or by some other means, and that a skin abscess is most often the result from the presence of the most common of these micro-organisms - *Staphylococcus epidermis albus*, but this organism has but slight virulence and hence the progress of the wound is but little interfered with.

In our work we have kept an account of history, causes and results of each case and careful observation of the reaction on different media, number of germs, and by the use of Chester's Manual of Determinative Bacteriology.

The material used was obtained from boils, bruises on knee,

sore on leg of lamb, pus from rifle ball wound, from shoulders of three calves after vaccination for Blackleg, and from ulcers found on intestine of hog after butchering.

The material from boils was taken from the ordinary boil which is so troublesome to man. The number of germs found in boils varied from one to seven, and while it may not be conclusive I found that the more acute the boil the larger number of germs it contained. The bruise on knee was caused by falling on a board floor. The sore at first appeared to be only slight but after about ten days time it became worse and formed large amounts of pus under the scab. Nothing was applied to the sore until after material was gathered and as it steadily became larger and more acute, a few applications of corrosive sublimate were used which healed it up. The number of germs obtained were four including *M. Pyogenes* *Vor Albus*, which is one of the most virulent pus producing organisms.

The material from the sore on lamb was not very important; it contained three organisms which are not very common. The origin of the sores was not ascertained, though it is thought that they were indirectly the cause of the death of the lamb.

The pus from the rifle wound was obtained by Dr. Cave a few days after the bullet was extracted, pus having formed in both the upper and lower wound. From this wound was obtained six germs, including two common ones, *M. Pyogenes* *vor aurens* and *M. pyogenes* *vor. albus*.

An Atchison farmer found on butchering a hog that some small abscesses appeared on the intestines and on lungs, the material was sent to the Department and I procured some of it and inoculated for results.

The material described above were the principal cases examined, although other material was examined with similar results. In my work a systematic method was used and care taken that all media and apparatus was perfectly sterile and the utmost care used in describing the growth and characteristics.

SPECIMEN A.

The material was obtained from a sore on my knee which was caused by a fall on a board floor. The sore at first seemed to be only a small bruise but after a few days pus began to form and resulted in a very bad sore and it was only after applying corrosive sublimate several times that it was checked and began to heal. After gathering some of the pus in a sterile test tube it was taken to the laboratory and an inoculation of a tube of bouillon made, and after forty-eight hours four colonies were readily distinguishable, and from each of these a separate tube of bouillon was inoculated and allowed to grow forty-eight hours then a full set of media was inoculated from each.

M. RUBESCEUS.

Morphology.-- Occur singly and in irregular groups.

Bouillon.-- A white sedimentary growth.

Agar.-- Pinkish, pigmentous growth on surface - Chromogenic.

Gelatin.-- Not liquified, villious growth, a long line of stab pinkish ,pigmentous growth on surface.

Potato.-- White pellicle-like growth.

Milk.-- No action.

L.Milk.-- No action.

Stained by Gram's method and non-motile.

M. FREUDENREICHII

Morphology.-- Occur singly and in pairs.

Bouillon.-- Cloudy, sedimentary growth.

Agar.-- White raised growth on surface.

Gelatin.-- Stratiform, liquefied.

Potato.-- White pus-like growth.

Milk.-- Digested.

L.Milk.-- Digested and decolorized.

Stained by Gram's method, are round or spherical shaped and Non-motile.

M. PYOGENES VAR ALBUS.

Morphology.-- Occur singly and in clumps.

Bouillon.-- Cloudy, white sedimentary growth.

Gelatin.-- Stratiform, liquefied.

Agar.-- White pus-like growth covering surface.

Potato.-- A raised yellowish pus-like growth on surface.

Milk.-- Slowly digested.

LlMilk.-- Decolorized and digested.

Stained by Gram's method; are round or spherical shaped and Non-motile.

M. AURANTICUS.

Morphology.-- Occur singly, in twos and in clumps.

Bouillon.-- Cloudy, white sedimentary growth.

Agar.-- Yellowish growth on surface, chromogenic.

Gelatin.-- Stratiform, liquefied slowly.

Potato.-- Yellowish pus-like growth.

Milk.-- No action.

L.Milk.-- Decolorized but not coagulated.

Stained by Gram's method, are round shaped and non-motile.

SPECIMEN B.

The material was taken from posterier limb of a lamb which was infected with running sores from which the lamb afterward died. The material was placed in a sterile test tube and taken at once to the laboratory where an inoculation into a tube of bouillon was made and allowed to grow forty-eight hours which developed a white, floating growth. An agar plate culture was then made and in forty-eight hours developed two distinct colonies and in two more days a third colony appeared which was chromogenic. Inoculation from each colony was made with the following results:

BACT. AROMATICUM.

Morphology.-- Round ends.

Bouillon.-- Turbid with floating growth.

Agar.-- White film-like growth.

Potato.-- Raised pellicle like growth.

Gelatin.-- Liquefied, stratiform.

L.Milk.-- Decolorized and digested.

Milk.-- Digested.

BACT. AROMATICUM.

Morphology.-- Rounds ends, white growth, turbid.

Bouillon.-- White growth, turbid.

Agar.-- Thin white growth.

Gelatin.-- Liquefied stratiform.

Potato.-- White growth.

Milk.-- Digested.

L.Milk.-- Decolorized and digested.

M .VIRIDIS.

Morphology.- Solitary, in pairs and in clumps.

Bouillon.- White perceptible settling to the bottom.

Agar.- Thin, white growth on surface.

Potato.- White pellicle like growth.

Gelatin.- Liquefied stratiform.

Milk.- Digested.

L.Milk.- Decolorized and digested, solid portion showing red color.

SPECIMEN C.

Material for this was taken from a boil on my upper lip, pus was gathered in a test tube and brought to the laboratory where an inoculation was made into a tube of bouillon and after forty-eight hours a whitish growth was visible. An agar plate^{culture} was then made which developed seven distinct colonies, some of them being chromogenic. From each colony a bouillon tube inoculation was made and after growth began a full set of media was inoculated with the following results:

M.AURANTIACUS.

Morphology.- Round or slightly oval, occur singly, in twos and in clumps. (small)

Bouillon.- White sediment settling to bottom of tube.

Agar.- Growth orange yellow.

Potato.- Slimy growth.

Gelatin.- Reddish pigment on surface, slowly liquefying with reddish sediment.

Milk.- Digested.

L.Milk.- Decolorized.

BACT. AQUATILES.

Morphology.- Filaments, grow rather slowly on ordinary culture media.

Bouillon.- White flocculated deposit.

Agar.- Glistening, grayish growth, limited.

Potato.- Growth yellowish.

Gelatin.- Liquefied slowly.

L.Milk.- Decolorized and digested.

Milk.- Coagulated.

M. POLYMYASITES.

Morphology.- cocci solitary and in pairs and groups.

Bouillon.- White flocculent deposit.

Agar.- Growth thick, grayish white.

Potato.- growth grayish white.

L.Milk.- decolorized and digested.

Milk.- Coagulated.

M. PYOGENES Var. Albus.

Morphology.- cocci, irregular clumps.

Bouillon.- Turbid with white deposit.

Agar.- Smooth, moist, glistening, orange colored growth.

Potato.- Abundant orange colored growth.

L.Milk.- Decolorized and digested.

Milk.- Digested.

B. PYOGENES MINUTISSIMUS.

Morphology.- Bacilli small of variable length, ~~Non~~-motile.

Bouillon.- White flocculent deposit.

Agar Slant.- Grayish limited growth.

Potato.- Yellowish growth.

L.Milk.- Decolorized and digested.

Milk.- Digested.

Gelatin.: Beaded growth in depth.

BACT. TENUE.

Morphology.- Small ends, non-motile.

Bouillon.- White flocculent deposit.

Agar Slant.- Grayish, slow growth.

Potato.- Yellowish growth.

Gelatin.- Beaded growth in depth.

L.Milk.- Decolorized and digested.

Milk.- No changes.

B.EXANTHEMATICUS.

Morphology.- Irregular size, some thick and short.

Bouillon.- Turbid with sediment and mambrane.

Agar Slant.- glistening and translucent growth.

Potato.- Beaded growth in depth.

L.Milk.- Decolorized and digested.

Milk.- No change.

SPECIMEN D.

The material was secured from a boil on the back of my neck. A bouillon tube inoculation was made and after forty-eight hours a whitish growth appeared. An agar plate culture was then made which developed one colony. A full set of media was then inoculated from this with the following results:

M. PYOGENES VAR. ALBUS.

Morphology.-- Cocci occur singly and in clumps.

Bouillon.-- Turbid with white sediment.

Agar Slant.-- White glistening growth.

Gelatin.-- Liquefied stratiform, with heavy sediment.

Potato.-- Growth thick and white.

L. Milk.-- No change.

Milk.-- Digested.

SPECIMEN E.

This material was obtained from shoulder of calf after vaccination, and an agar culture made by dilution method which gave the following results:

B. SMARGDINUS.

Morphology.-- Occur singly and in pairs.

Bouillon.-- Turbid with dense flocculent sediment.

Agar Slant.-- Thin, light yellow growth.

Gelatin.-- Liquefying along line of stab, surface growth green.

Potato.-- Dark brown growth.

Milk.-- Yellow precipitate in bottom.

B. AURESCENS.

Morphology.-- Occur singly, are short spindle shaped, being 2 or 3 times longer than broad.

Bouillon.-- Turbid with flocculent sediment.

Agar.-- Yellow film-like growth.

Gelatin.-- Slight growth in depth, surface yellow, after short time crateriform depression.

Milk.-- Digested.

M. LACTIS.

Morphology.-- Cocci round, very large.

Bouillon.-- Turbid.

Agar.-- Thin, dry whitish growth.

Gelatin.-- Growth along line of stab, also surface. Growth not liquefied.

Potato.-- Creamy, slimy growth.

L.Milk.-- Small precipitate.

Milk.-- No change.

M. CEREUS .

Morphology.-- Cocci large, in pairs, tetrads and small clumps.

Bouillon.-- Turbid with white sediment.

Agar.-- Light white growth.

Gelatin.-- Yellow growth on surface, also growth along line of stab. Edges slightly elevated.

Potato.-- A creamy, yellowish slimy growth.

L.Milk.-- Coagulated clear liquid on top.

Milk.-- Coagulated.

M. JONGII.

Morphology.-- Variable in size, singly and in clumps.

Bouillon.--m Precipitate in bottom, slightly turbid.

Agar.-- Light growth, doubtfully chromogenic.

Gelatin.-- Not liquefied, growth along line of stab.

Potato.-- Shite, heavy pellicle growth.

L.Milk.-- Slightly coagulated.

Milk.-- Slightly coagulated.

SPECIMEN F.

Material for this was obtained from rifle wound and bouillon tube inoculation made, then agar plate culture with following results:

M.PYOGENES VAR.ALBUS.

Morphology.-- Occur singly and in clumps.

Bouillon.-- Turbid, slight scum on surface, heavy sediment.

Agar.-- White growth.

Gelatin.-- Liquefaction rapid, later a white sediment formed.

Potato.-- Thick white growth.

Milk.-- Coagulated.

M.VITICULOSIS.

Morphology.-- Cocci oval, occur in masses.

Bouillon.-- White sediment in bottom.

Agar.-- Whitish green growth.

Potato.-- A dirty whitish growth.

Gelatin.-- Not liquefied orborescent.

M.PYOGENES Var.AUREUS.

Morphology.-- Cocci occur in irregular clumps.

Bouillon.-- Clear with heavy yellow sediment.

Agar.-- Glistening growth turning to bright orange.

Potato.-- Slight growth, orange color.

L.Milk.-- Acid coagulated.

Milk.-- Coagulated.

Gelatin.-- Liquefaction saccato with yellowish sediment.

M.SIMPLEX.

Morphology.-- Cocci of medium size, in pairs, tetrads and clumps.

Bouillon.-- Turbid, white flocculate growth on surface and white sediment.

Agar.-- Milk white growth.

Gelatin.-- Filiform growth in depth with stratiform liquefaction.

Potato.-- Slight growth of whitish color.

L.Milk.-- Decolorized and digested.

Milk.-- Digested.

STR. ERYSIPELITAS.

Morphology.-- Occor in chains.

Bouillon.-- Turbid, clearing up with heavy sediment.

Agar.-- A raised, white irregular growth. Grow in separate chains.

Gelatin.-- Not liquefied. Beady growth in depth.

Potato.-- No growth visible.

Milk.-- Coagulated.

L.Milk.-- Blue color changed to pink. Coagulated.

STR. CAPSULATAS.

Morphology.-- Cocci appear in long chains.

Bouillon.-- Very turbid.

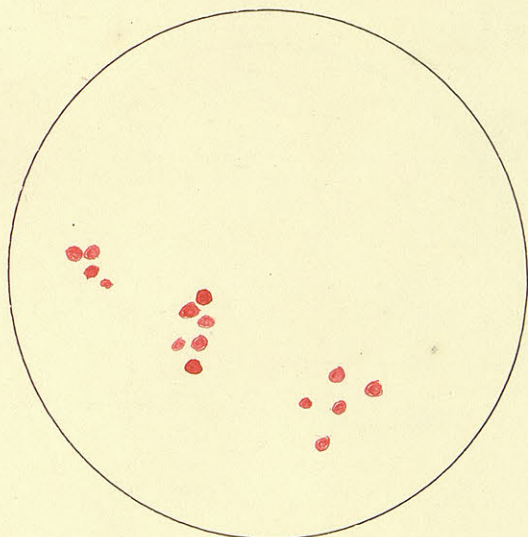
Agar.-- Transparant grayish growth.

Gelatin.-- Slowly liquefied.

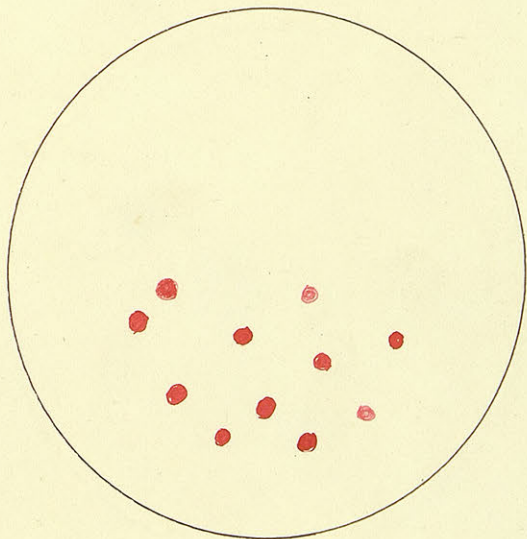
Potato.-- No growth.

Milk.-- Coagulated.

From these facts and data we can draw the following conclusions, that the number of germs varied and that while some of them are very virulent, others are of minor importance, and probably little concerned in the progress of the wound.



M. RUBESCEUS.



M. FREUDENREICH I.



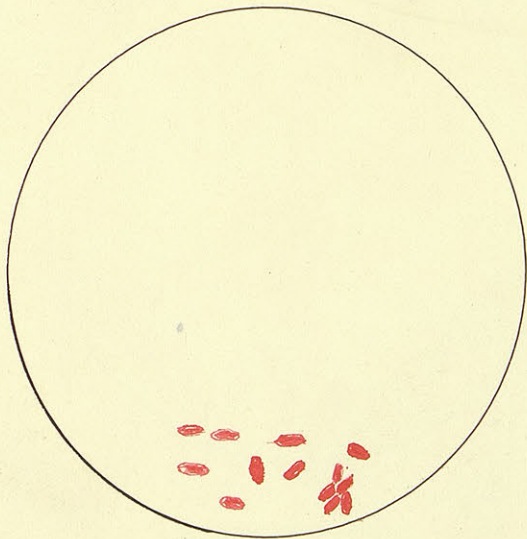
M. PYOGENES VAR. ALBUS.



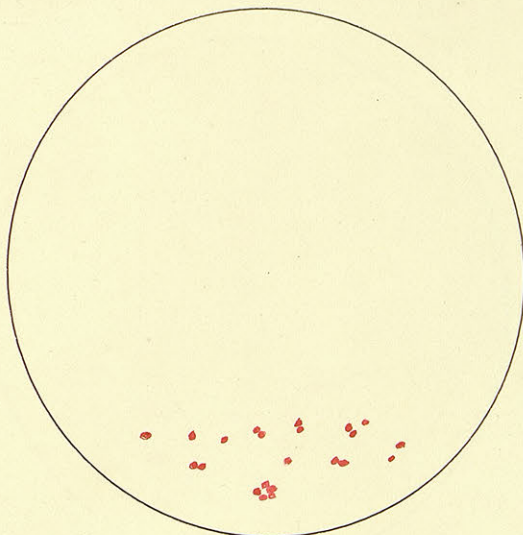
M. AURAMTICUS.



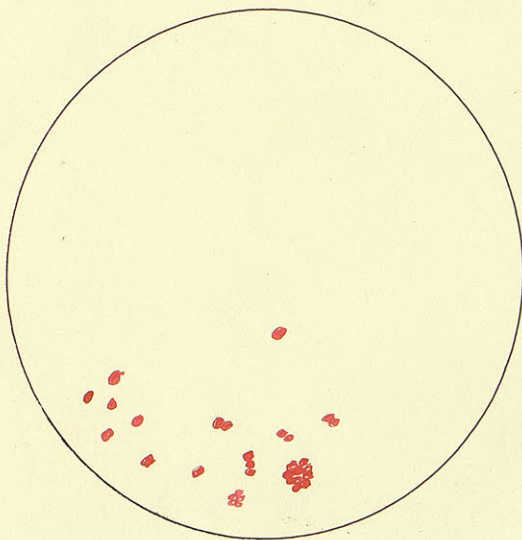
BACT. AUROMATICUM.



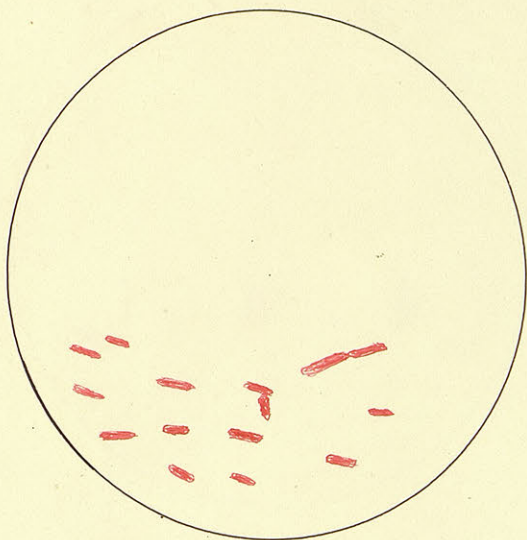
BACT. AUROMATICUM.



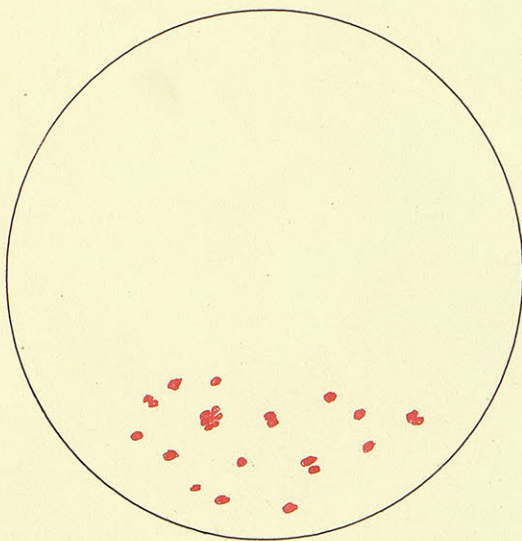
M. VIRIDIS.



M. AURANTICUS.



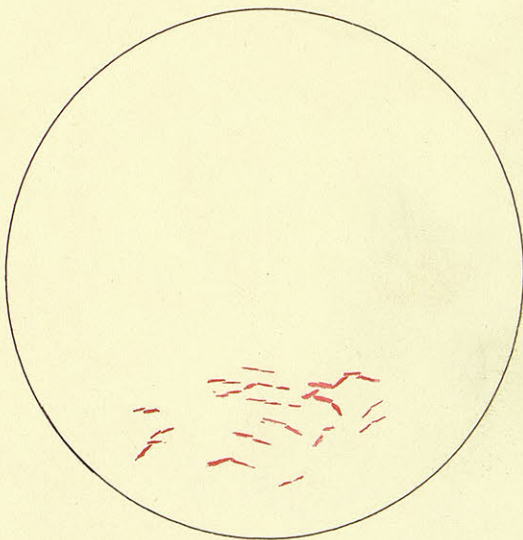
BACT. AQUATILES.



M. POLYMGASITES.



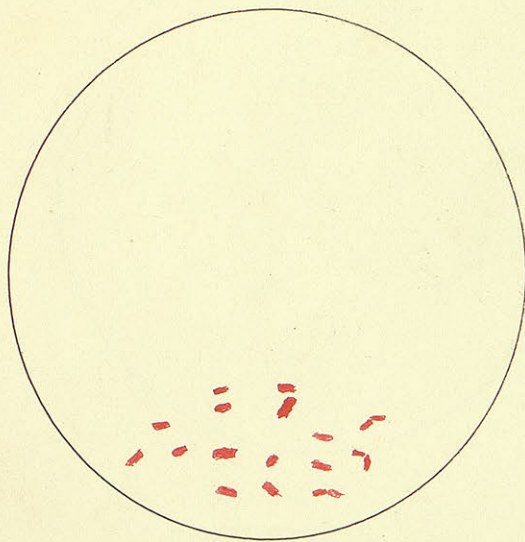
M.PYOGENES Var.ALBUS.



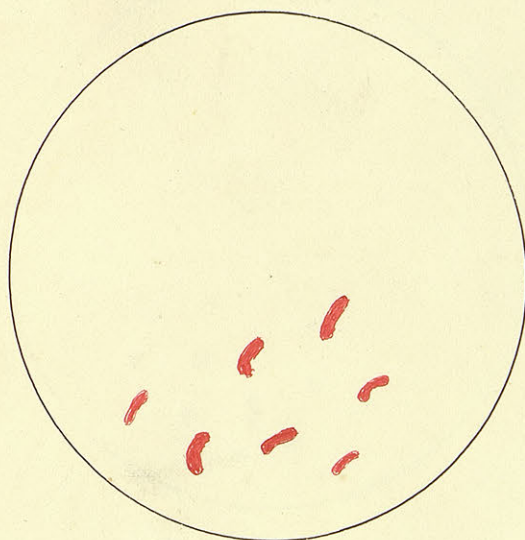
B.PYOGENES MINUTISSIMUS.



BACT. TENUE.



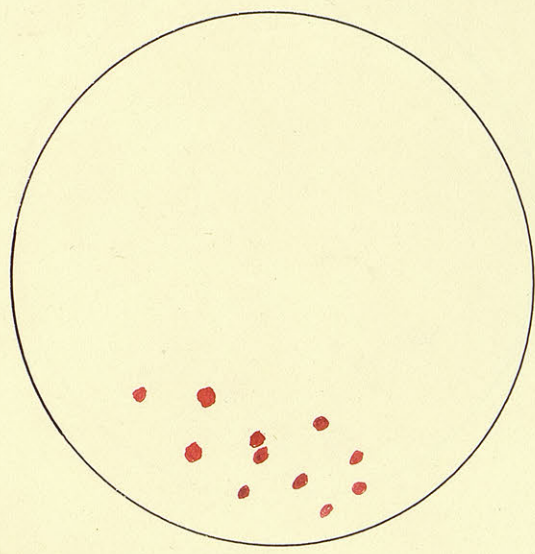
B. EXANTHEMATICUS.



B. SMARGDINUS.



B. AURESCEUS.



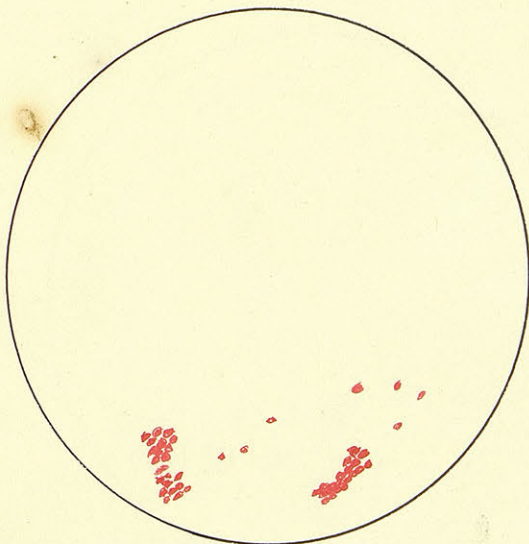
M. LACTIS.



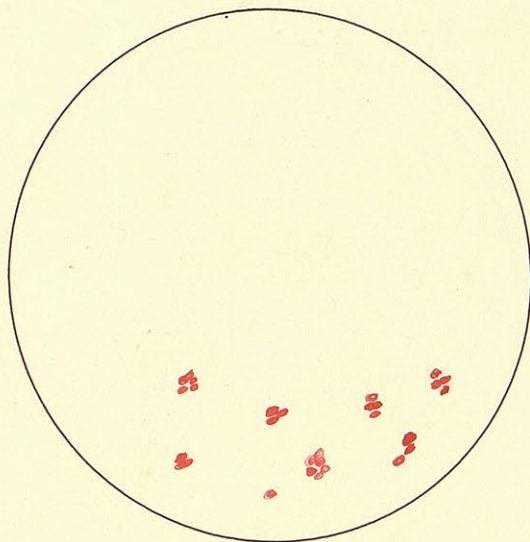
M. CEREUS.



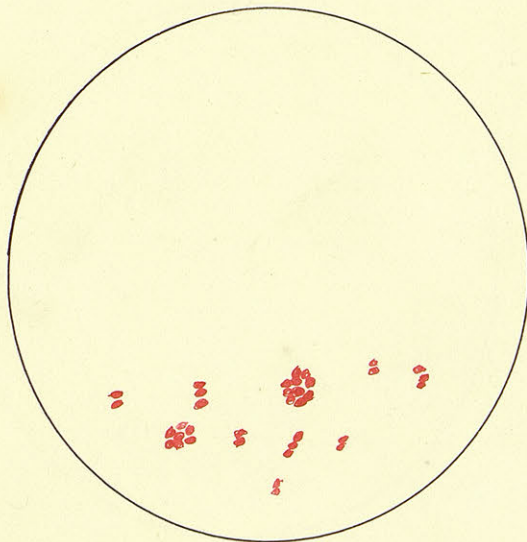
M. JONGII.



M. VITICULOSIS.



M. PYOGENES Var. AUREUS.



M. SIMPLEX.



STR. ERYSIPELATUS.



STR. CAPSULATUS.