STREPTOCOCCUS OF YOGURT ENHANCED WITH SEVERAL ILLUMINATION TECHNIQUES

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BACKGROUND

Bacteria has been in the world for thousands of million of years and they are an important part of our life, they live with us and in us, since they are present in our mouth, our skin our digestive tract, etc. They are also every where and it is true that many species of bacteria cause infections to our bodies producing sicknesses, some of them fatal if untreated. Nevertheless some are very useful and are important components in dairy products such as cheese, cream, yogurt, and it is precisely this that we are going to see today.

Watching bacteria is one of the most amazing things that we can do with an optical microscope, since they are very, very small, even more than protozoa to whom they serve as food. Obviously like most microscopic beings they are transparent and for that reason we have to use methods of illumination to see them.

Yogurt is the product of milk bacterial fermentation, in this case made by a streptococcus which is a kind of bacterial organization and morphology in order to classify since streptococcus species always look like rosary beads. The most common species that produces yogurt is *Streptococcus termophilus* which is what we are going to observe in the pictures.

- ILLUMINATION TECHNIQUES USED IN THIS PRESENTATION.

I used here several methods illumination, and some of the functions that my camera has such as the negative, colour scale and the gray scale, allows us to appreciate perfectly the sample.

- DARK FIELD

Dark field microscopy which represents a beautiful method of illumination, is similar as if we were looking at the sky in a clear night with tons of stars shining. It is easy to produce even when you do not have a dark field microscope. You can use the same condenser of a bright field one to produce it, because the principle of dark field is extremely simple. The only thing that you have to do is to block the passing of the light in the center of the condenser or in the source of light of your microscope with a stop. For that you can use a lot of things, for example a small coin, a small circle of black cardboard or black plastic, i.e. something opaque. The rule is that the size of the stop must be greater than the numerical aperture of the objective, so the light that reaches your sample is the one that passes around the stop. It is amazing isn´t it? With this simple procedure you can observe tons of microscopic things.

- OBLIQUE ILLUMINATION.

Oblique illumination is another beautiful form of illuminating a sample in the microscope. It is another one easy to do and the only thing that you need is to cut a black circle made of black cardboard, black plastic, etc., that fits perfectly the filter tray, or the source of light of your microscope. To that circle you have to cut a small opening in one extreme of the circle's diameter, which can be any form you want (generally it is used as a small circle), to allow light to pass out of the center. With this you will enhance contrast in the sample with a kind of three dimensional relief and of most use with high magnification.

In this we use circular oblique illumination which is a kind of oblique illumination with the difference that this is made of a central stop that blocks light as in dark field plus several light and dark circles. Circular oblique illumination is widely discussed in the articles in the MICSCAPE LIBRARY by Paul James from the UK.

My filter for circular oblique illumination:

- DIY-DIC.

This is a kind of filter for the oblique illumination technique that uses a black circle with a small hole in the center, which is covered originally with a blue translucent patch, and at one extreme of the black circle, a half moon shaped opening. I particularly have used other color centers like the red one that I used here in this presentation.

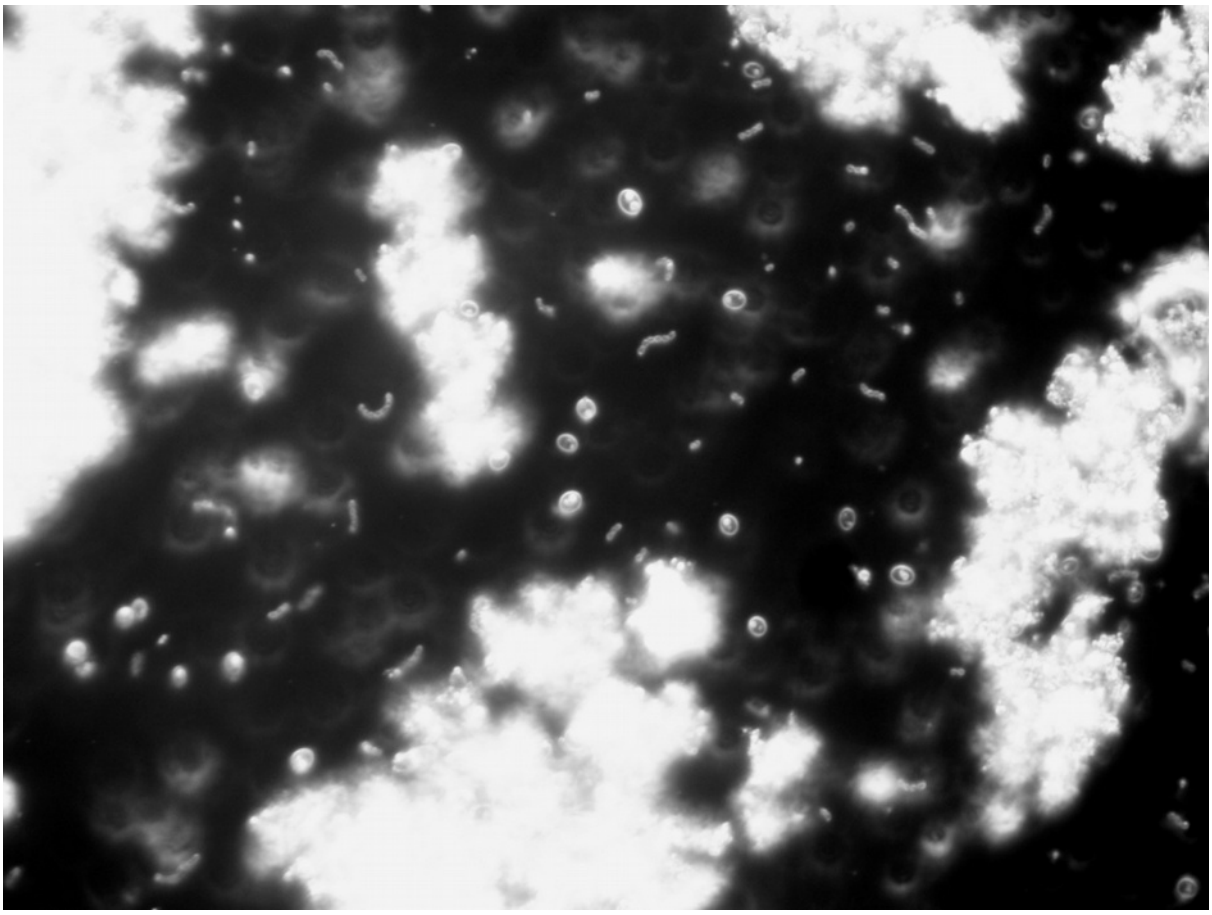
The filters that I used in this presentation:

- NEGATIVE FORM OF LIGHTING.

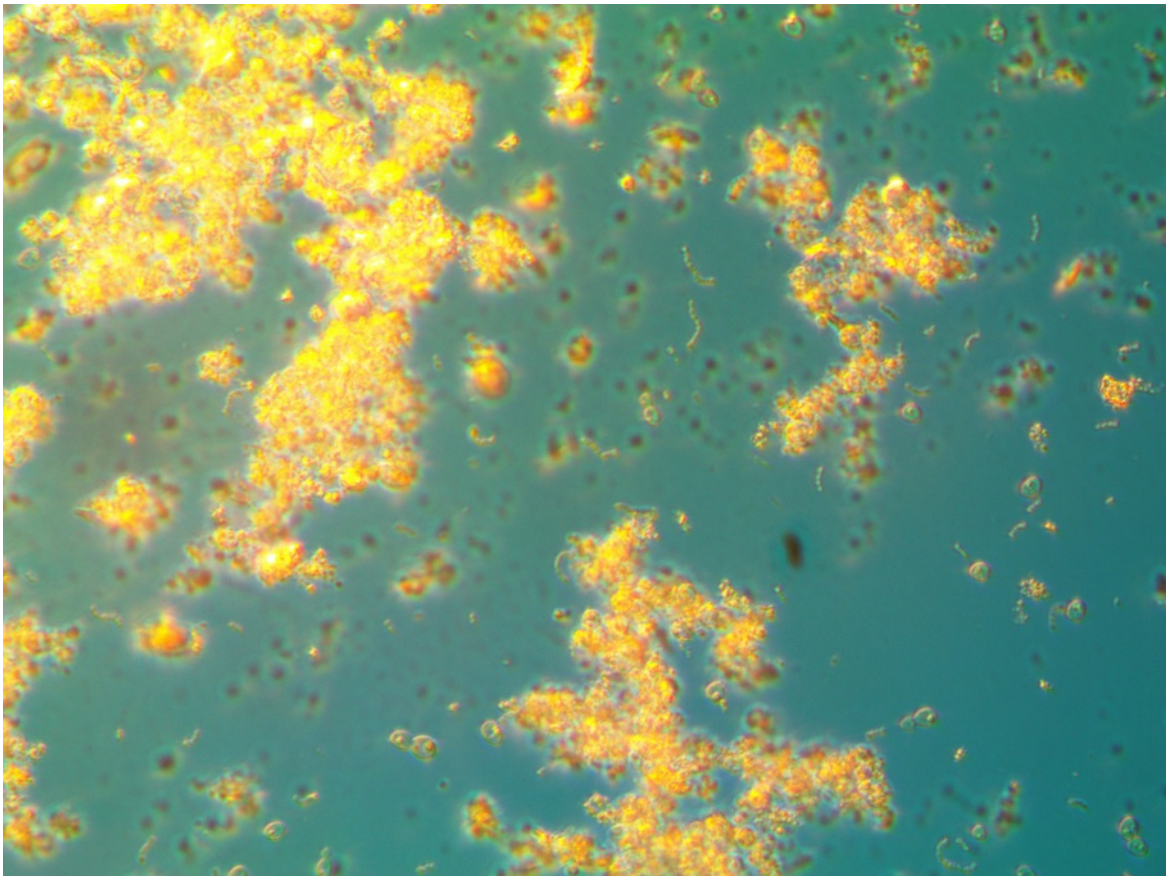
Modern cameras have a lot of functions such as white balance, color and gray scales, and in the case of mine also has a negative lighting effect, which enhances a picture changing the color to a negative one, for example black is seen white, white is seeing black a so on, now I combine in this presentation both the color and the negative effects of the camera with the dark field condenser and with the bright field one with a filter on the filter tray or without it.

- RESULTS

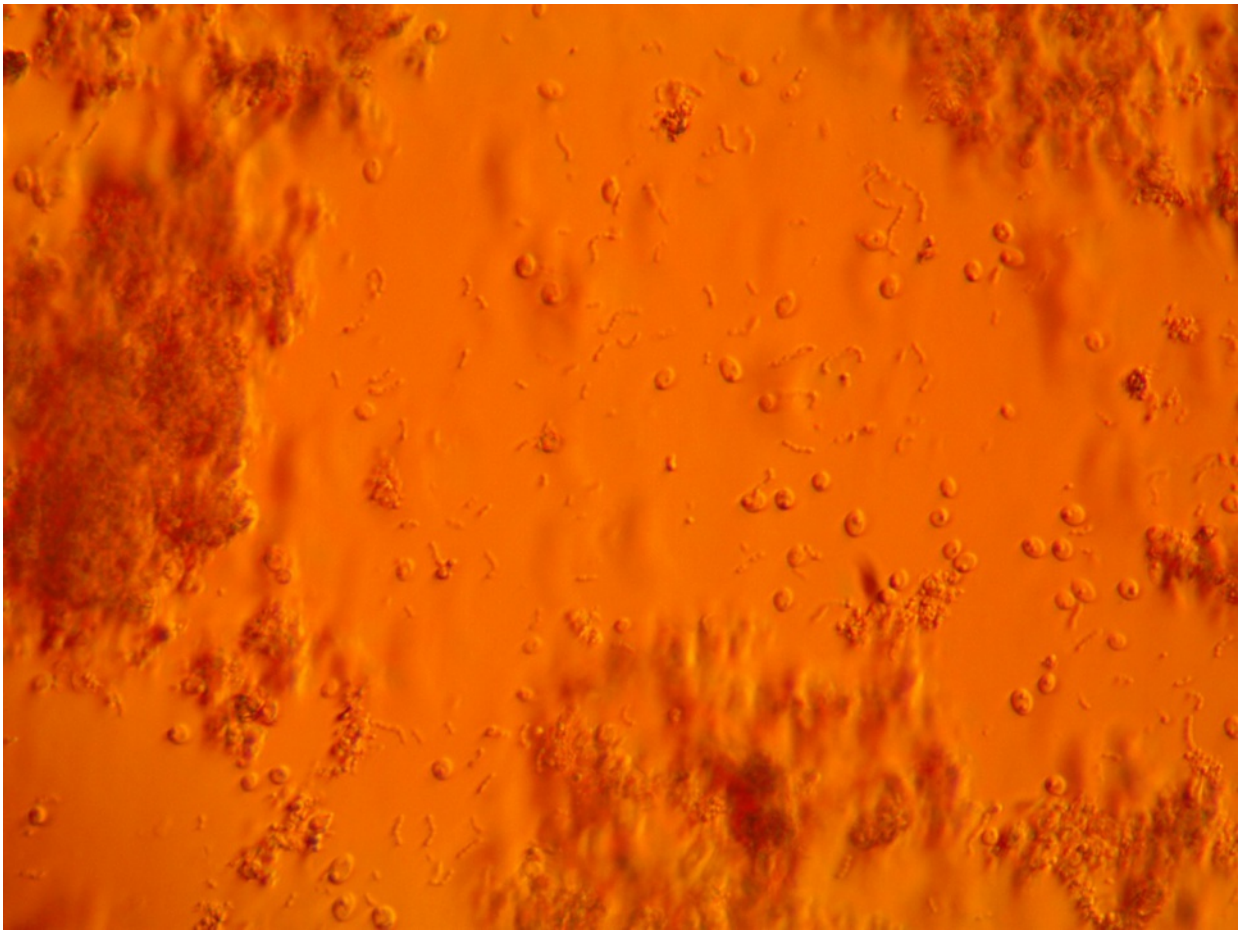
Here are the samples of a drop of yogurt diluted in some purified water. I have kept in refrigeration this yogurt for several months in my refrigerator, that is the reason you can appreciate in the sample apart of the streptococcus that you can see like small bead-like chains. The ovals or circles are a strain of fungi that grew in the yogurt container and that is also diluted in the sample. Diplococcus are also seen in the pictures.



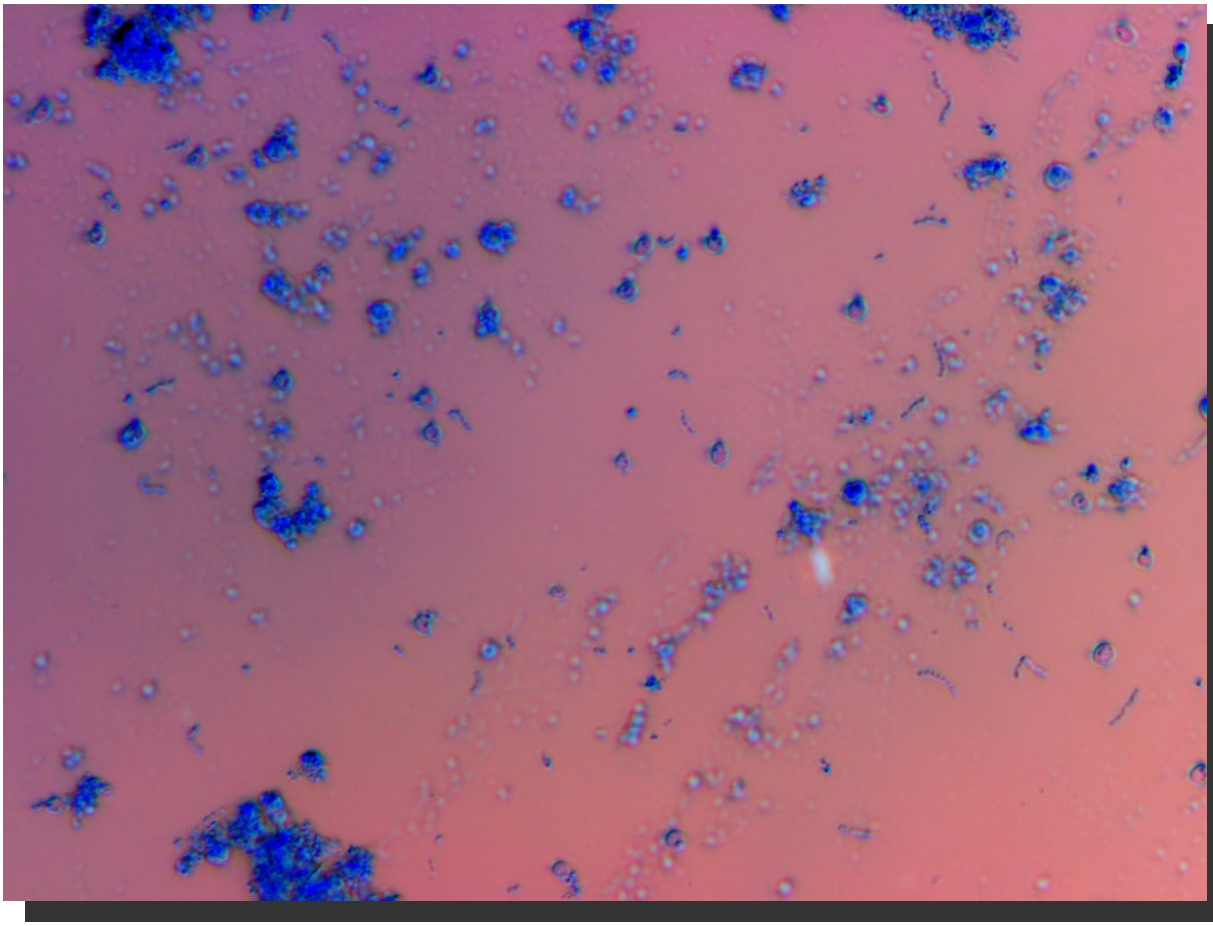
Streptococcus 40x 5MP darkfield with enhanced contrast 100, colour temperature 6503K, tint 1000.

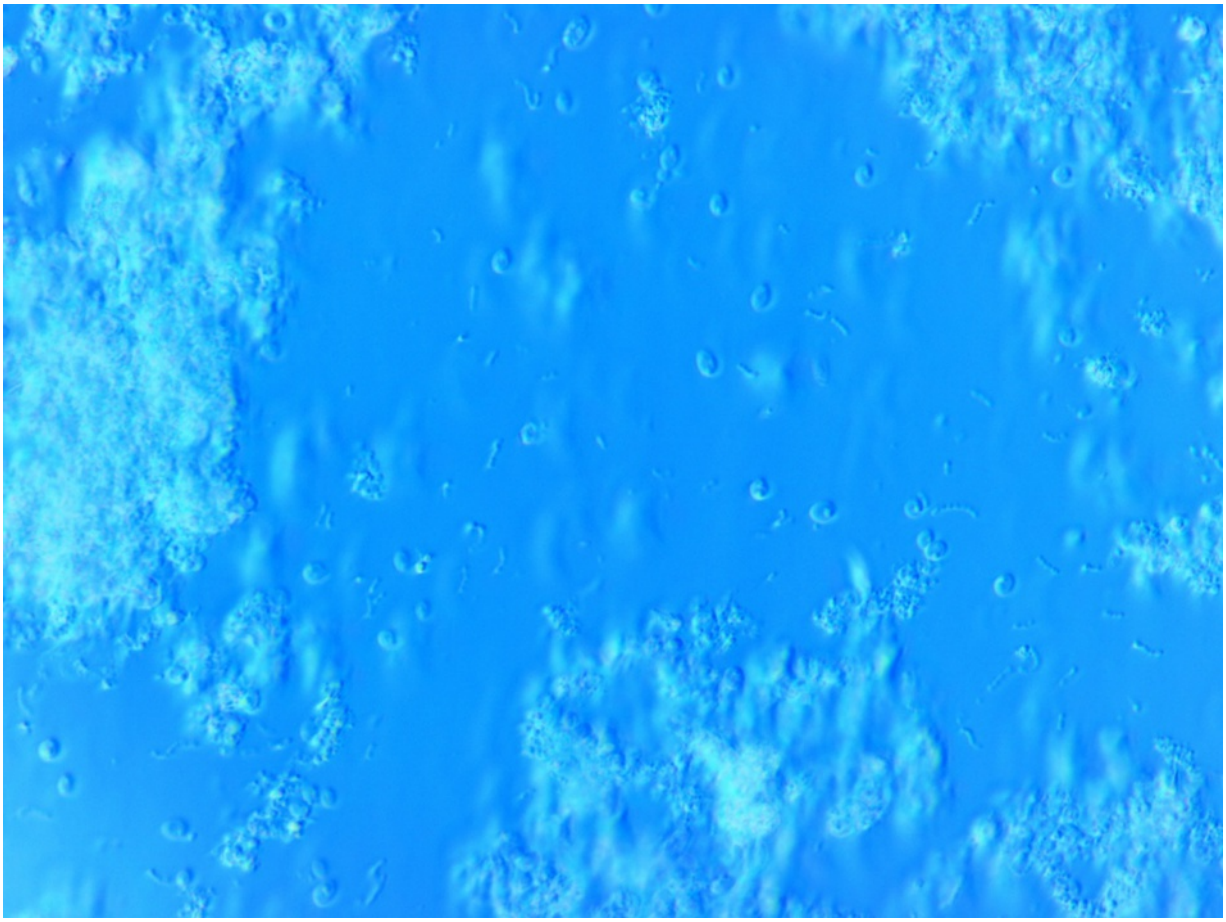


Streptococcus 40x 5MP DIY-DIC blue center.

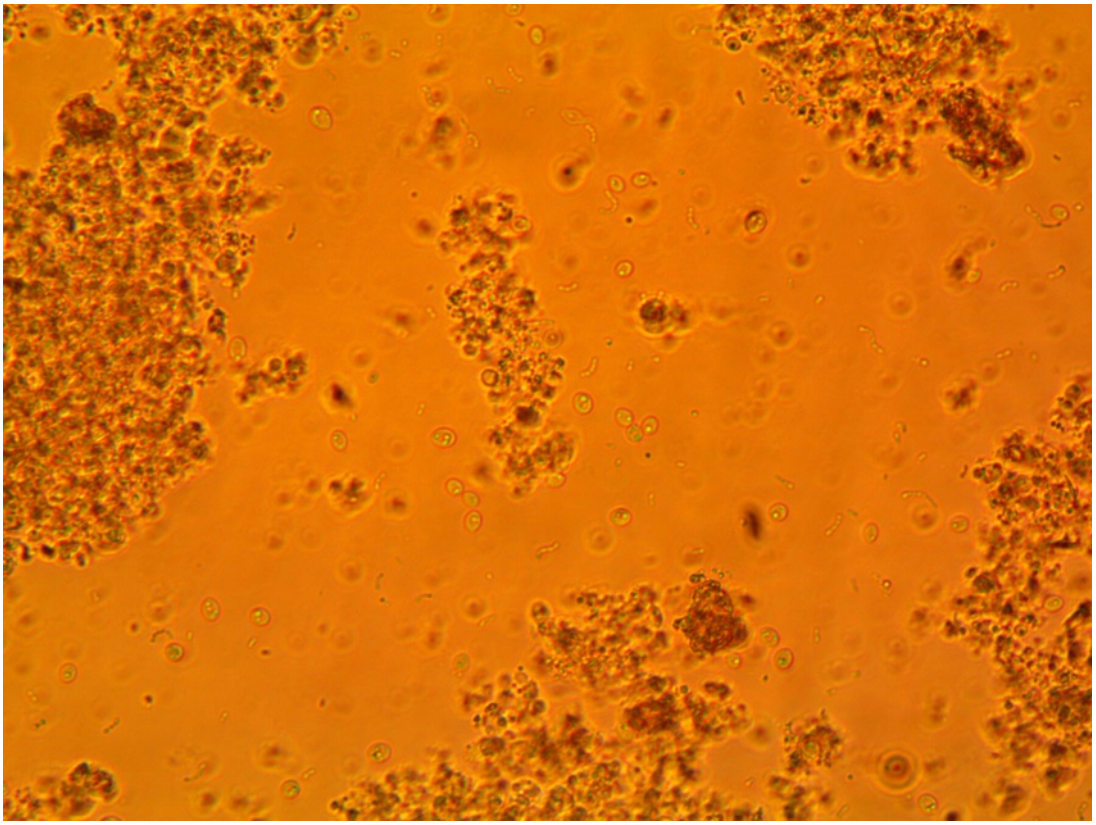


Streptococcus 40x 5MP DIY-DIC red center.

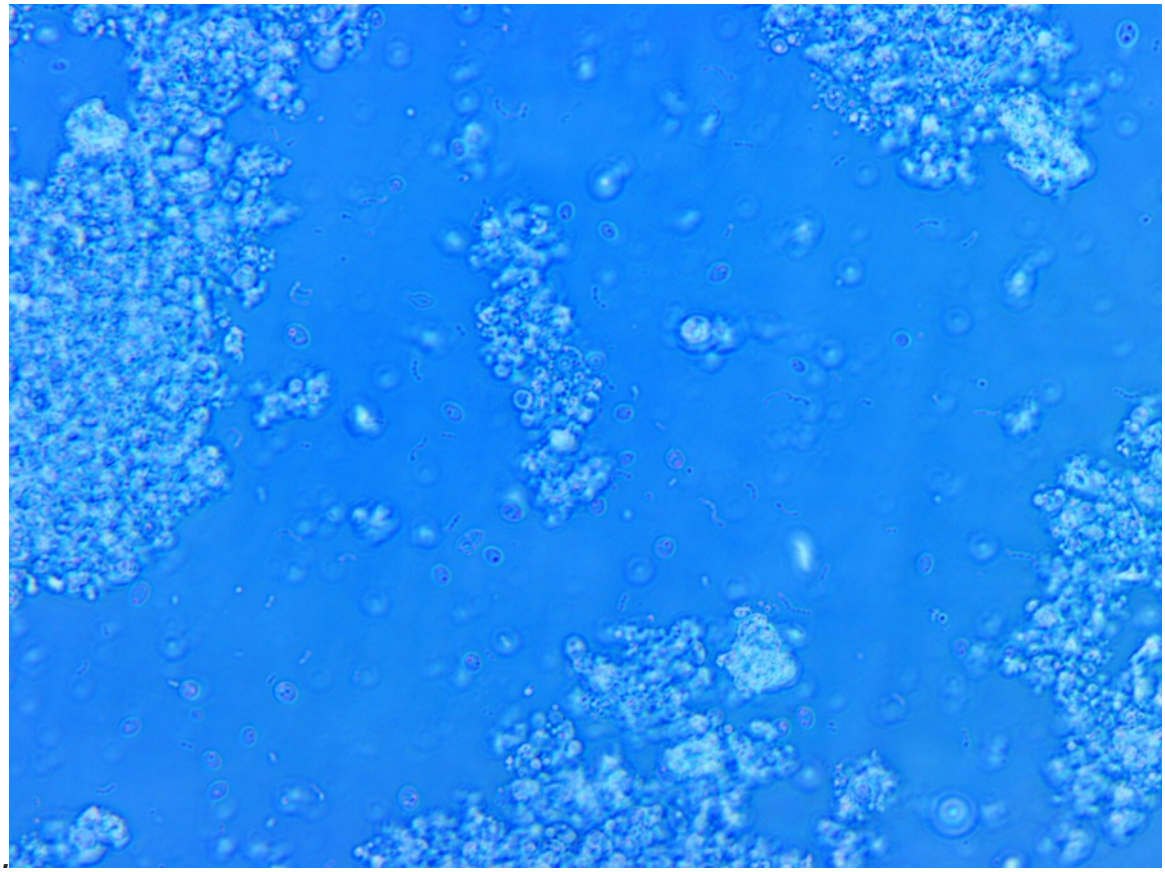




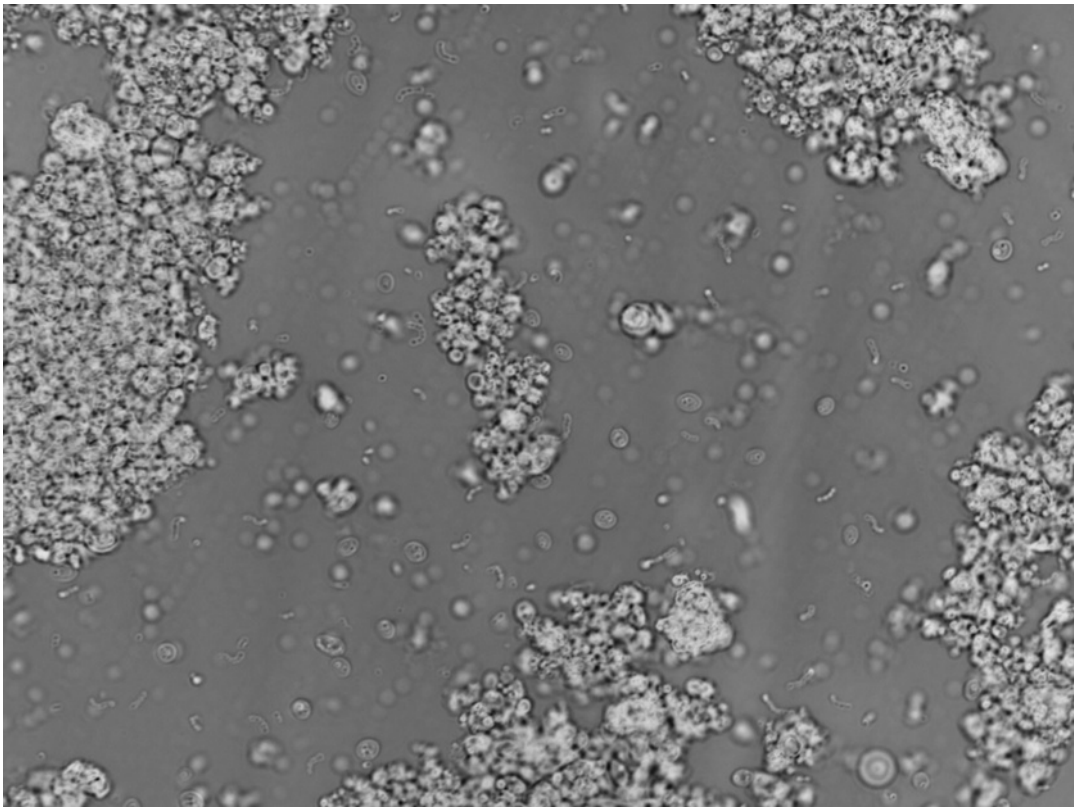
Streptococcus 40x 5MP DIY-DIC red center negative effect of the camera.



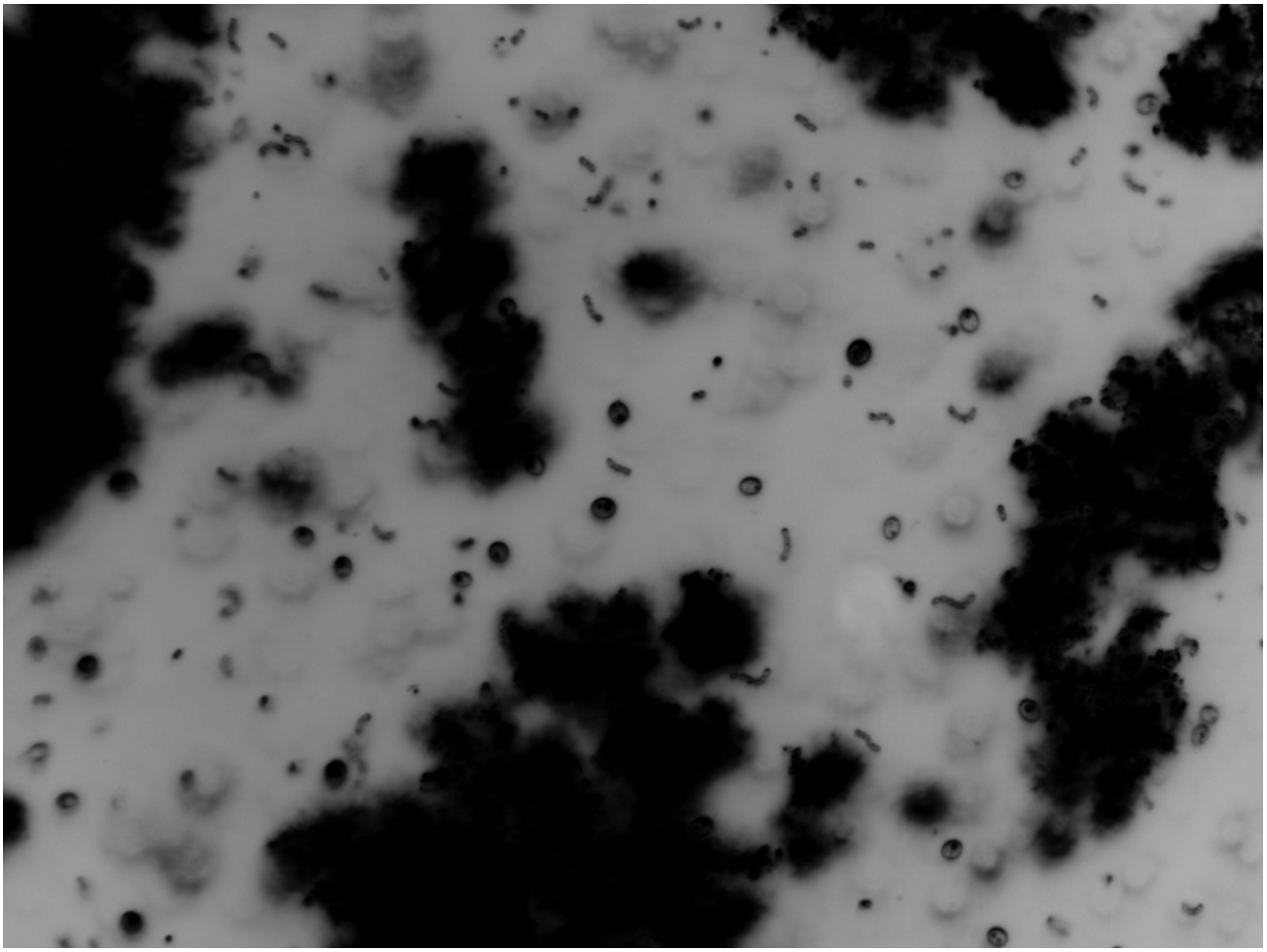
Streptococcus 40x 5MP circular oblique illumination



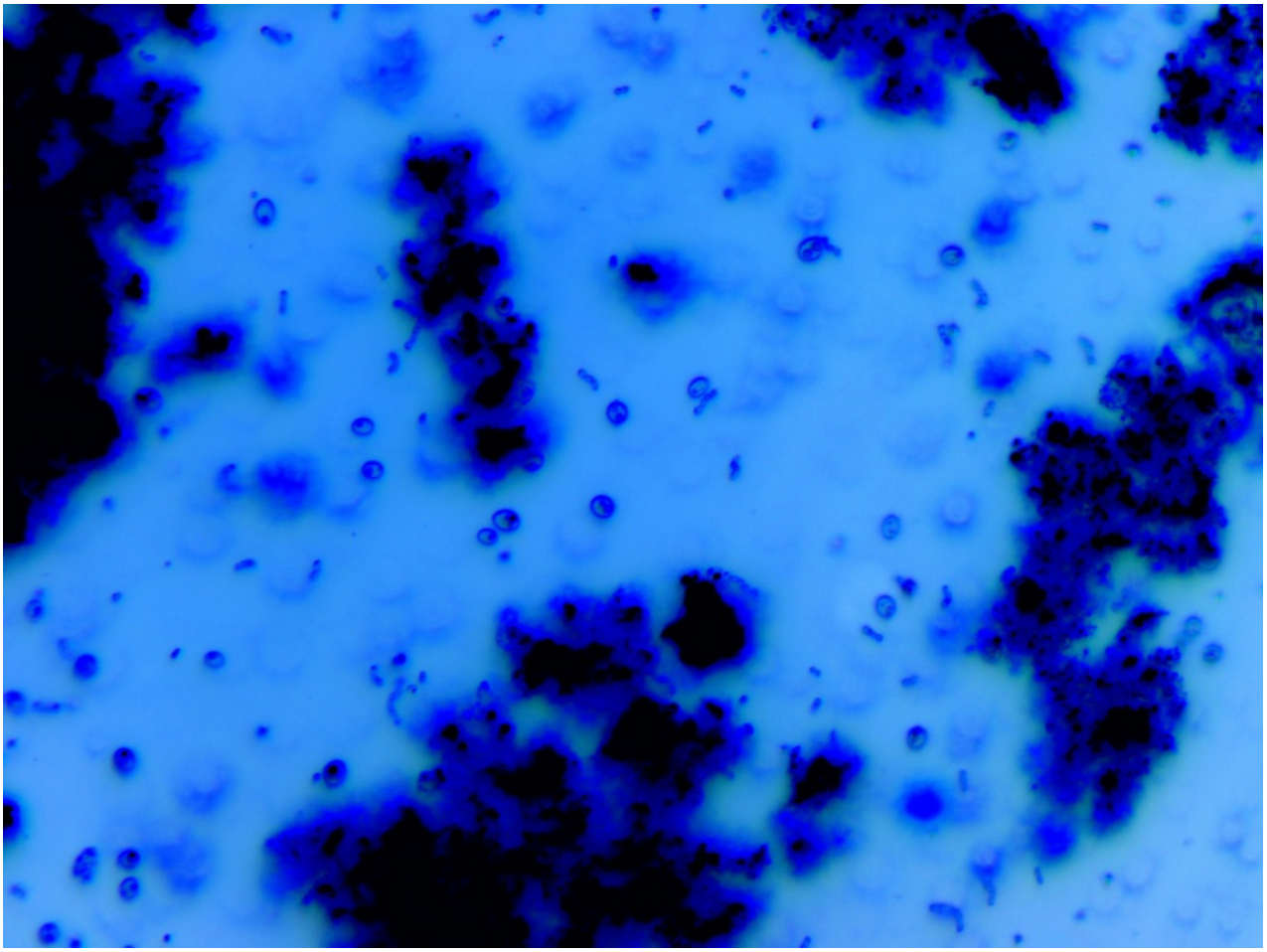
Streptococcus 40x 5MP circular oblique illumination negative effect of the camera.



Streptococcus 40x 5MP gray scale plus negative effect of the camera.



Streptococcus 40x 5MP dark field condenser plus gray scale plus negative effect of the camera.



Streptococcus 40x 5MP dark field condenser plus color scale plus negative effect of the camera

CONCLUSION:

As you can see, the enhancement of a microscopic sample can be achieved in several ways, the only thing that you have to do is to use the resources you have at hand. If you still do not have a camera, just try the observation with the suggestions that are presented in the MICSCAPE library. I tried them before having my camera, and I had a lot of fun. Now that I have my camera I have taken advantage of the functions it has and believe me it gives me more fun while observing this marvelous miniature world.

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(Above in anti-spam format. Copy string to email software, remove spaces and manually insert the capitalised characters.)

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