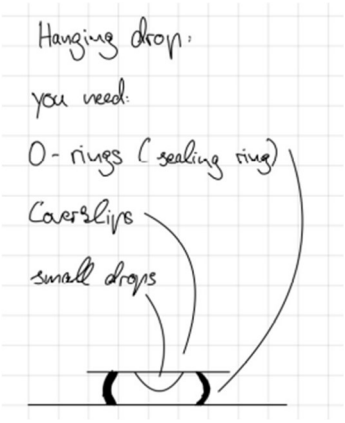
Magnetotactic bacteria

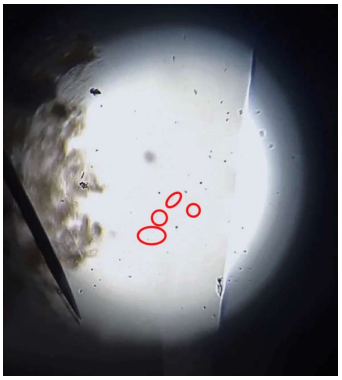
Hello everyone,
At HASE we are working together with the LMU (Ludwig-Maximilian-Universität München). In the LMU there is a group studying magnetotactic bacteria. Trying to understand why they are magnetic and so many things more, the group needs a lot of data. How to get data? Observing... as much as possible. But, of course, they have limited resources. There, we can help them by providing data.
Our goals are:
- collecting samples
- analyzing the samples (currently only qualitative, later maybe also quantitative)
- developing a procedure for the analysis
- saving the data, possibly later in an online database

In this letter, I want to explain how we can determine the existence of the bacteria in a sample. At LMU they have a microscope which looks at the sample from below. We don't have such microscopes in our school, so we have to use a trick. Due to the curvature of the water drop, no bacteria can be seen from the top view, but there is a trick to viewing the bottom of the sample: by turning the drop upside down.



Brian has drawn it. You need a microscope slide and coverslip. One drop is put on the coverslip. Then you set the O-ring (just something so that there is space for the drop between the glasses) on the coverslip, then the slide. You take both and turn it upside-down, hoping that the drop will hang on the coverslide. With a hanging drop, you can observe the magnetotactic bacteria using a top-view microscope.

The mud from the sample collects in the middle, so that you have a clear edge. Now you have to use a magnet to let the bacteria go to the edge. The bacteria go to a magnetic south pole.



After waiting a bit, you should see the bacteria swim. They are very very small (2-4 µm), I marked a few for you on the right.

We used a magnification of 40x and 100x - don’t expect to see details of the bacteria, just moving dots.

They are best identified by rotating the magnetic field (briefly pointing the north pole towards the sample, then again the south pole), so that you can observe the magnetotactic bacteria changing their swimming direction.

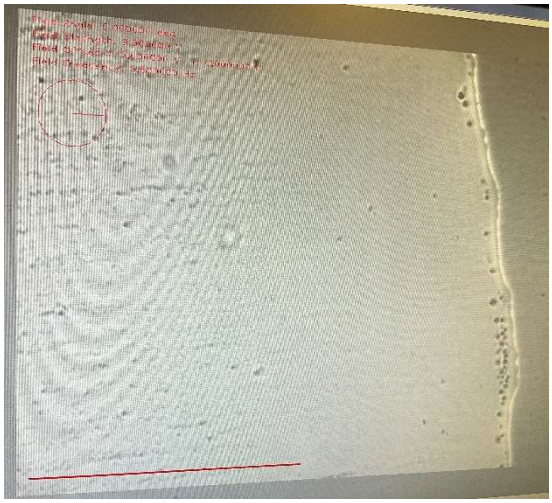
How to collect samples? We have never done it yet, but I will try to explain it briefly. Samples are taken from lakes or small streams. Using a kitchen ladle, possibly attached to a pole or broomstick, you can collect some mud from the top layer at the bottom of the lake/stream, not too far away from the shore. You need mud, not water, but top it off with a little bit of lake water, and collect some additional water in an extra container. Best wear rubber boots and wade a little bit into the shallow water.

After collecting the sample, it should be stored without moving for 7 to 14 days. The bacteria should be stored in darkness. We let the containers with the samples open (half covered with the lids), so the bacteria can breathe. This leads to the water slowly evaporating, and this is where the extra water comes in, with which you can occasionally refresh your samples, so they don't dry out.

The picture on the right shows how the samples are stored at LMU.

For sampling a drop to observe with the microscope, use a pipette to obtain mud from around 0.5 cm below the surface.

The last picture shows a microscopic image from the LMU microscope, which is much better than ours. Also it shows a near perfect sample with a lot of magnetotactic bacteria at the right side, where the water drop ends and they can't swim any further. We hope to improve our observation methods, to get the digital cameras attached to our school microscopes to work, and to build some magnetic coils with which to control the magnetic field in a way to make the bacteria "dance".



I hope that I was able to show you a bit. If you have questions, don't hesitate to ask us.
We will try to record a video for you which we will send you as soon as possible (I think we can explain the procedure much better in a video).

Best regards,
Felix
on behalf of the entire HASE-DeepDyn team