ESRF	**Experiment title:** Structural study of the DNA / neutral lipid / water system: a free standing film experiment.	**Experiment number**: SC-1044
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Report:

The aim of the experiment was to obtain new information about the structure of the DNA/neutral lipid/water system. Particularly, we planned to obtain the DNA-DNA correlation peak evolution with respect to the water concentration. Using a well oriented sample with free standing films, we expected to obtain for the first time the complete structure of our system: correlation layer by layer, 2D or 3D organization, nematic or smectic order, short or long range order, phase transition. The use of the ID02 beam line was crucial for this experiment in order to obtain sufficiently high instrumental resolution, maximum intensity and 2D detection.

The various samples were prepared and controlled at the CRPP before the run. In order to optimize the run, two different geometries were used.

Step 1: we worked with non oriented samples using standard capillaries. We studied different samples with various DNA and water concentrations. As can be seen in figure 1, we obtained the classical diffraction pattern showing 5 orders of the lamellar phase and the DNA-DNA correlation peak. We were able to verify the exact composition of our samples in order to choose the best one (good dilution, not dried !) for the film experiments.

Step 2: using the special oven designed at the CRPP for free standing films, we drew films with samples of different compositions. The oven was temperature controlled but not humidity controlled. For this reason, we saturated the oven environment with water in order to limit water evaporation from the sample. The film was quite difficult to obtain (4 hours) without adding an excess of water. This was due to a very high viscosity of our sample caused by the large amount of DNA and by the slow evaporation of the water.

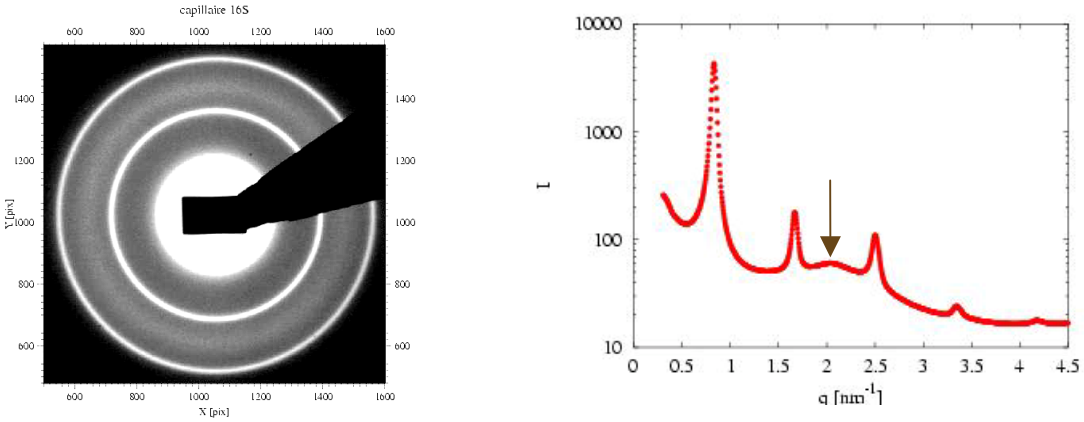

Figure 1 : Diffraction pattern obtained of a capillary for DNA / neutral lipid / water system with 42% of water and weight% lipid / weight % DNA = 2. The arrow shows the DNA-DNA correlation peak.

We finally made 4 films with a very dilute lamellar phase (60% of water or more) with weight% lipid / weight % DNA = 2. Each film was made with an excess of water.

In order to check the film orientation, we made scans using the reflectivity geometry.

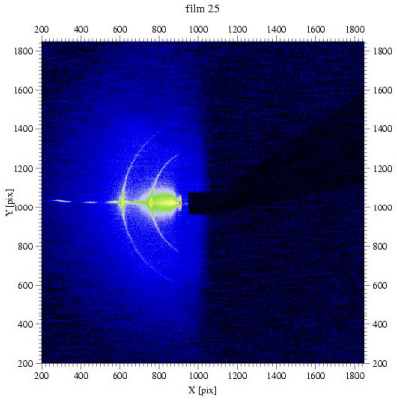

Figure 2-a

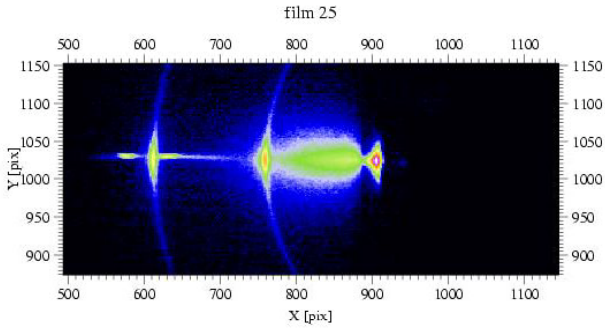

Figure 2-b

Figure 2-a shows an example of the image obtained in the reflectivity geometry. Only half of the detector was illuminated. Figure 2-b is a zoom of figure 2-a. We clearly recognize the first, second and third order for the lamellar phase. The signal is clearly anisotropic, proof of a very well oriented sample, as expected from a freely suspended film. We showed that the signal observed between the first and second order of the lamellar phase corresponds to the specular reflection. Finally, the signal around the third order peak is due to parasite reflections (oven borders).

Conclusion : We showed that it is possible to obtain freely suspended films of the lytropic lamellar phase and very well oriented samples with our DNA / neutral lipids / water systems. Unfortunately, we were unable to observe the DNA signal. The main reason is that it was impossible to control the composition of the sample in the film geometry, either because DNA was leaking outside the lamellar phase towards the water excess or because water was slowly evaporating from the film. From these observations, it is clear that controlling the humidity in the oven chamber will be necessary to go further in the structural study of the DNA / lipids / water systems. We have designed a new temperature and humidity controlled chamber which should be operational soon for that purpose.