EUROPEAN **S**YNCHROTRON **R**ADIATION **F**ACILITY

INSTALLATION EUROPEENNE DE RAYONNEMENT SYNCHROTRON

ESRF

Experiment Report Form

The double page inside this form is to be filled in by all users or groups of users who have had access to beam time for measurements at the ESRF.

Once completed, the report should be submitted electronically to the User Office using the **Electronic Report Submission Application:**

http://193.49.43.2:8080/smis/servlet/UserUtils?start

Reports supporting requests for additional beam time

Reports can now be submitted independently of new proposals – it is necessary simply to indicate the number of the report(s) supporting a new proposal on the proposal form.

The Review Committees reserve the right to reject new proposals from groups who have not reported on the use of beam time allocated previously.

Reports on experiments relating to long term projects

Proposers awarded beam time for a long term project are required to submit an interim report at the end of each year, irrespective of the number of shifts of beam time they have used.

Published papers

All users must give proper credit to ESRF staff members and proper mention to ESRF facilities which were essential for the results described in any ensuing publication. Further, they are obliged to send to the Joint ESRF/ ILL library the complete reference and the abstract of all papers appearing in print, and resulting from the use of the ESRF.

Should you wish to make more general comments on the experiment, please note them on the User Evaluation Form, and send both the Report and the Evaluation Form to the User Office.

Deadlines for submission of Experimental Reports

- 1st March for experiments carried out up until June of the previous year;
- 1st September for experiments carried out up until January of the same year.

Instructions for preparing your Report

- fill in a separate form for each project or series of measurements.
- type your report, in English.
- include the reference number of the proposal to which the report refers.
- make sure that the text, tables and figures fit into the space available.
- if your work is published or is in press, you may prefer to paste in the abstract, and add full reference details. If the abstract is in a language other than English, please include an English translation.

ESRF	**Experiment title:** Bridging the divide between lyotropic phase transitions in model membranes and ex-vivo systems	**Experiment number**: SC-2905
Beamline: ID02	**Date of experiment**: from: 24/4/2010 to: 27/4/2010	**Date of report**: 27/8/2010
Shifts: 9	**Local contact(s)**: Michael Sztucki	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

Imperial College London, UK
Nicholas Brooks *
John Seddon *
Oscar Ces
Richard Templer

Technical University Dortmund, Germany
Roland Winter

Report

We have made significant recent progress in understanding the pressure dependent phase behaviour of model membrane systems and investigating the kinetics of their phase transitions triggered by pressure jumps.[1-5] During experiment SC-2905 we have been able to translate the techniques and expertise that we have developed using pure, synthetic lipids to natural cellular lipid extracts.

We have extensively investigated the temperature and pressure dependence of polar lipid extracts from the bacteria Escherichia coli and total lipid extract from the mitochondria of starved and fed samples of the amoeba Chaos carolinensis. In addition, we have carried out pressure jumps to investigate phase transitions in C. carolinensis samples.

Highly hydrated E. coli polar lipid extracts were shown to adopt a lamellar phases which is remarkably resilient to changes in temperature and pressure – samples were studied in the range 25 to 88 °C, and 1 to 3800 bar and only a change in lamellar layer spacing was observed. However on dehydration of the lipid sample, there is evidence for formation of a 2-D hexagonal structure at 25 °C and around 2500 bar.

Lipid extract from the mitochondria of fed and starved amoeba in excess water show significant differences in their phase behaviour as shown in Figure 1 below. Pressure jumps show reproducible structural change paths. Data analysis is ongoing to find the structures and intermediates involved in these transitions.

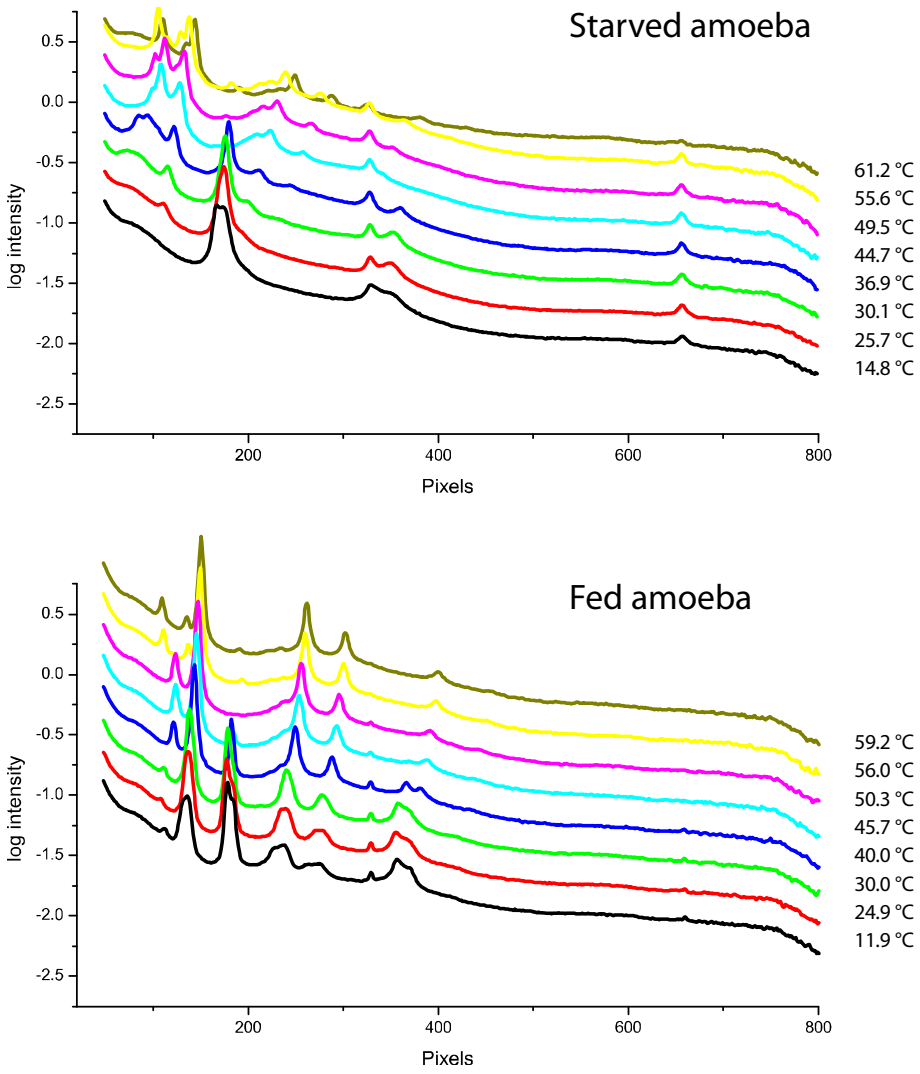

Figure 1. Temperature dependent small angle diffraction patterns from lipid extracts from the mitochondria of starved and fed Chaos carolinensis amoeba

References

1. A. Squires, R. H. Templer, J. M. Seddon, J. M. Woenkhaus, R. Winter, T. Narayanan, S. Finet, *Phys. Rev. E.,* 2005, **72**, 011502
2. C. E. Conn, O. Ces, X. Mulet, S. Finet, R. Winter, J. M. Seddon and R. H. Templer, *Physical Review Letters*, 2006, **96**, 108102
3. J. M. Seddon, A. M. Squires, C. E. Conn, O. Ces, A. J. Heron, X. Mulet, G. C. Shearman and R. H. Templer, *Philosophical Transactions of the Royal Society a-Mathematical Physical and Engineering Sciences*, 2006, **364**, 2635
4. C. E. Conn, O. Ces, A. M. Squires, X. Mulet, R. Winter, S. M. Finet, R. H. Templer and J. M. Seddon, *Langmuir*, 2008, **24**, 2331
5. A. Squires, C. E. Conn, J. M. Seddon, R. H. Templer, *Soft Matter,* 2009, **23**, 4773