	Experiment title:	Experiment number:
	Understanding the mechanism of x-rays damage: membrane lipids.	SC668
Beamline:ID02A	**Date of experiment**: from: 30˚April˚2000˚ ˚05˚May˚2000	**Date of report**:
Shifts: 9	**Local contact(s)**: Panine Pierre	*Received at ESRF:*

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Report:

The call for brighter synchrotron x-radiation sources for use in structural biology research is barely audible as we enter the new millennium. Our brightest sources are already creating havoc when used at design specifications because of radiation damage. The time is long overdue to take stock of where we are and where we wish to go with regards to using existing sources and to designing new ones. The problem of radiation damage is particularly severe in studies involving kinetics and mechanism where cryotechniques are not always viable. Accordingly, we need to understand the very nature of radiation damage and to devise means for minimizing it. This is the thrust of the current study as applied to lipid membranes and mesophases. Here, we report on two very different types of radiation damage. One involves a dramatic phase transformation and the other a disordering of lamellar stacking. How beam energy and dose/rate affect damage is also discussed. The work highlights the nature of the damage process and the need for additional studies if we are to make most efficient use of an important resource, synchrotron radiation.

This experiment demonstrates clearly that damage can seriously compromise the utility of synchrotron x-radiation in studies of the structure of lipid-based model membrane systems. Damage was found to be expressed in very different ways depending on the lipid and its phase propensity. In one case, the effect was to enhance stacking disorder. In the other, a massive phase change took place. The effects of incident beam energy and dose/rate were

also studied. The results highlight the need for additional careful studies of these and related incident beam effects and of how they are modulated by the chemical and environmental properties of the sample. It is imperative that we set about the task of characterizing quantitatively these unwanted effects and of establishing strategies and protocols for minimizing them. In this way, most efficient use can be made of existing synchrotron facilities and sagacious decisions made regarding fourth, and possibly later, generation machines. Our concern for radiation damage is now being shared by the macromolecular crystallography community (Weik *et al.*, 2000; Ravelli *et al.*, 2000).

Work published in :

V. Cherezov, A. Cheng, J.-M. Petit, O. Diat and M. Caffrey

"**Biophysics and synchrotron radiation: Where the marriage fails. X-ray damage of lipid membranes and mesophases.**"

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