ESRF	**Experiment title:** MICRO DIFFRACTION ON KERATIN FIBRES	**Experiment number:** LS 371
Beamline: ID13 - BL1	**Date of Experiment:** from: 9/2/96 to: 11/2/96	**Date of Report:** 27/2/96
Shifts: 6	**Local contact(s):** P. ENGSTRÖM	*Received at ESRF :* 29 FEB 1996

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Report:

Aim of the experiment

We have performed microdiffraction experiments on beamline BLl on several different keratin materials: hard alpha-keratin (human hair, horse hair and porcupine quill) and feather keratin. All of them are fibres, which means that they are oriented along one axis. The samples we used had already been studied on station D43 at LURE for wide and small angles, and station D24 for very small angles. The aim of this six-shift experiment was twofold:

- to reveal the presence of an outer layer (cuticle) between the external medium and the microfibrils (cortex) by X-ray diffraction. The existence of a cuticle is known from microscopy but had never been characterized by X-ray diffraction because of its thinness and the impossibility to separate it from the cortex. We also wanted to have a clue to the structural transition between cuticle and cortex; the cuticle is expected to be more or less amorphous while the cortex gives rise to a very rich alpha-keratin diffraction pattern. But nothing precise is known about the frontier between the two zones.

- to study the internal structure of the cortex as a function of the position; in particular, we were interested in the evolution of the structural patterns while scanning. the samples from the surface to the core.

Description of the experiment

The experiments were performed on beamline BLl between the 9th and 1 1th february. We have used a two micron diameter glass capillary as collimator, the signal of which unfortunately appears on our images as a diffuse ring around 4.5Å. We have recorded WAXS patterns at a distance of 12Omm with a CCD camera and an average exposure time of thirty. seconds. It has not been possible to get usable SAXS images because of the intense central diffusion taking place around the beam stop; some improvements of the experimental equipment seem to have solved this problem since. Even our WAXS images have been disturbed by this central diffusion so we could not see the reflection we expected around 40Å, which is supposed to be characteristic of the cuticle.

Early results

The preliminary results we obtained from our experiments have revealed some interesting features:

- X-ray diffraction patterns of the cuticle alone have been obtained for most of the samples; it appears to be actually amorphous and containing lipid layers, which organization is not clear. It is too early to extract information about the cuticle-cortex transition from our data because of the little amount of time we have had to analyse them so far.

- in the cortex, keratin microfibrils seem to behave in a different way depending on the nature of the sample. Some of them have basically a cylindrical symmetry (we call them one-dimensional samples), as human or horse hair; the others are asymmetric and will be referred to as two-dimensional samples. In the cortex of the latter, the orientation of the microfibrils varies with the distance to the surface; it was supposed to remain parallel to the sample axis but it actually rotates up to a 90” angle. As far as we know from our early results, this does not happen in one-dimensional samples.

We need to improve our knowledge on the internal organization in keratin fibres, which includes the orientation of microfibrils, the nature of the cuticle and the properties of the transition zone between cuticle and cortex. This requires to perform small angle microdiffraction on our samples to have an overview of the changes of the diffraction patterns in the three zones.