| ESRF | **Experiment title:** SAXS studies of breast tissue samples carrying malignant tumors | **Experiment number:** LS-2096 |
|---|---|---|
| **Beamline:** ID02 | **Date of experiment:** from: 07.11.2001 to: 09.11.2001 | **Date of report:** February 18, 2002 |
| **Shifts:** 8 | **Local contact(s):** V. Urban | *Received at ESRF:* |

**Names and affiliations of applicants** (* indicates experimentalists):

* P. Suortti, Dept. of Physicsl Sciences, University of Helsinki.

* M-L. Karjalainen-Lindsberg, Dept. of Oncology, Helsinki University Cental Hospital.

* W. Thomlinson, ESRF.

Report:

The experiment was continuation of a previous experiment, which has been reported (LS-1695). The same method was used, and SAXS patterns were recorded from thin tissue samples. Prior to the experiment, histological sections were prepared of the samples, and maps of the tissue types and their pathological changes were made. The measurements focused on areas where substantial amounts of collagen were present, because the first experiment indicated that collagen has different structures in healthy tissues and in tissues invaded by cancer.

Collagen molecules form fibrils, which have a characteristics period in the axial direction. This period is about 65 to 67 nm, depending on the tissue type. In healthy breast tissues the collagen period is 65.0±0.1 nm, and the fibrils form bundles, which are packed in an approximately hexagonal array. This regular arrangement seems to break up when cancer invades, or the arrangement is not developed in newly-formed collagen associated with cancer growth. The collagen period increases by about 0.3 nm, and the bundles dissociate to coils.

The SAXS patterns obtained in this experiment confirm the earlier findings, and include information which suggest directions for future research. Figure 1 illustrates characteristic changes in the SAXS pattern due to invasion of cancer. The average intensity and collagen period increase, and the diameter of the bundles decreases. Figure 2 demonstrates the effects of radiation damage in ordered collagen. The average intensity increases, but the axial period decreases. Also the collagen reflection (009) becomes broader indicating breaking of the fibrils.

The above results give detailed information about the structural changes of collagen due to cancer growth and irradiation. The changes in the SAXS patterns can be used for imaging, when more evidence and statistics of the characteristics features are obtained.

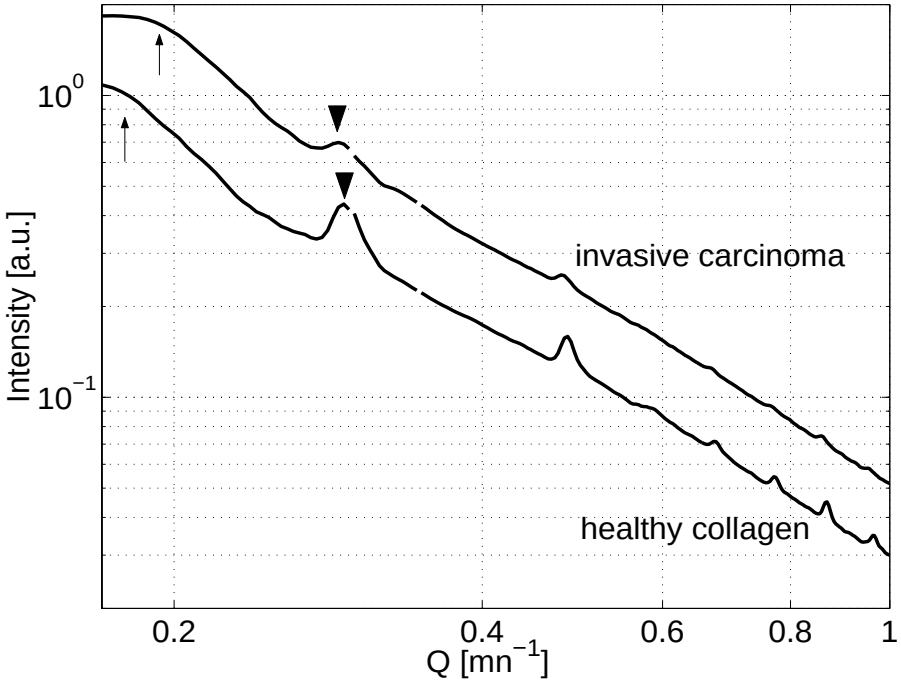


**Figure 1:** Collagen period increases (triangles) and the fibrils became smaller in invaded collagen (arrows). Collagen peaks broaden and mean intensity increases.

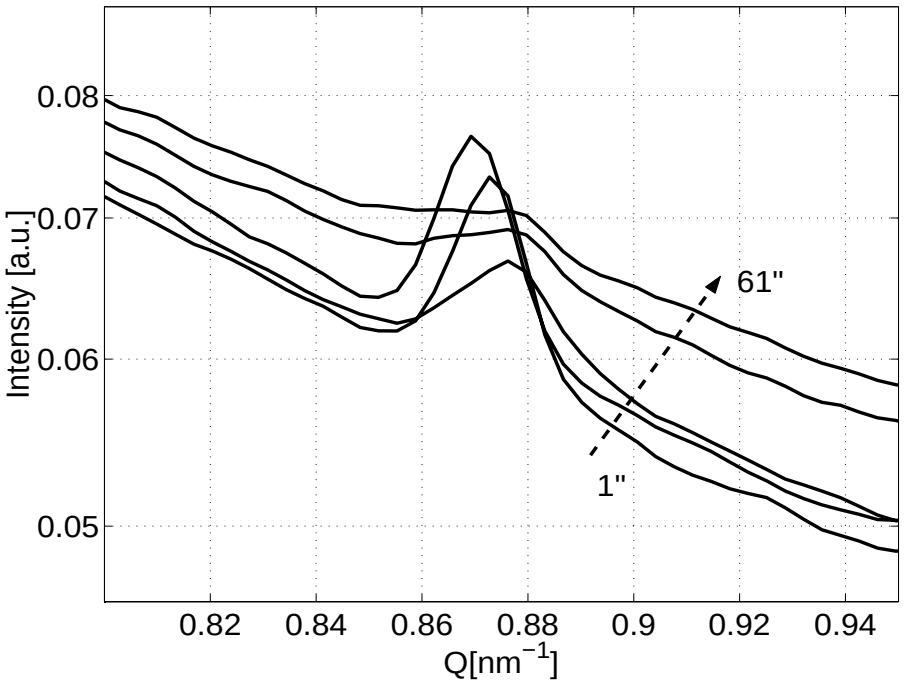


**Figure 2:** Radiation damage. Peaks broaden and shift and mean intensity increases with increasing dose. Number indicate exposure time in seconds.