

## Longitudinal Variation of Ca Content in Medulla of Human Hair from Breast Cancer Patients

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### 1 Introduction

Human hair is known to maintain time-dependent information about human blood contents from a hair root to a hair tip, because it grows at an average of 1cm per month with nutrition through the contact with blood only at the root site. Possible application of Ca variation in human hair was reported for the forecast of the incidence of breast cancer [1]. Although many factors are supposed to affect Ca content in hair such as external oxidative damage, we have proposed that Ca content in medulla, a central part of hair, would reflect Ca content in blood [2]. In the previous report, we compared Ca content and oxidative damage in hair samples obtained from breast cancer patients, and concluded that oxidative damage that increases with increasing distance from a hair root does not correlate with Ca content in medulla, in contrast to the apparent correlation with Ca content in cuticle, an outer part of hair [3]. In the present study, we extended the number of Ca measurements and compared Ca content between breast cancer patients and normal females.

### 2 Materials and Methods

X-ray contact microscopy was used for imaging Ca at the Ca-K edge at BL-11B with a spatial resolution of about 0.5  $\mu\text{m}$ . Ca mapping of high sensitivity was also performed by detecting X-ray fluorescence (XRF) upon X-ray microbeam exposure with a diameter of around 5  $\mu\text{m}$  at BL-4A. The hair specimens were kindly supplied from women suffered from breast cancer based on informed consent at Tokai University Hospital. The hair was cut in a thickness of about 20  $\mu\text{m}$ , and attached on SiN membrane as described previously [2].

### 3 Results and Discussion

Figure 1 shows Ca contents in medulla from hair root to tip for breast cancer patients (a) and for normal females (b). Ca content normalized with S content used as an index of hair thickness was plotted against the distance from the hair root. The results of four samples from each group were shown. Samples drawn with bold line have relatively low Ca content, which are shown with the left vertical axis, while samples with broken lines have high Ca content shown with the right vertical axis. It should be noted that Ca content in hairs from breast cancer patients has a trend of large variation depending on the position from the hair root. On the other hand Ca content in

normal female hairs seems to exhibit less variation although an increasing trend of Ca content is seen with increasing distance from the hair root. In addition, the measurements with XRF gave similar results. The positions indicating high Ca content observed in cancer samples should be discussed considering the information about cancer size and the portion of growing phase in cancer tissue (Ki value).

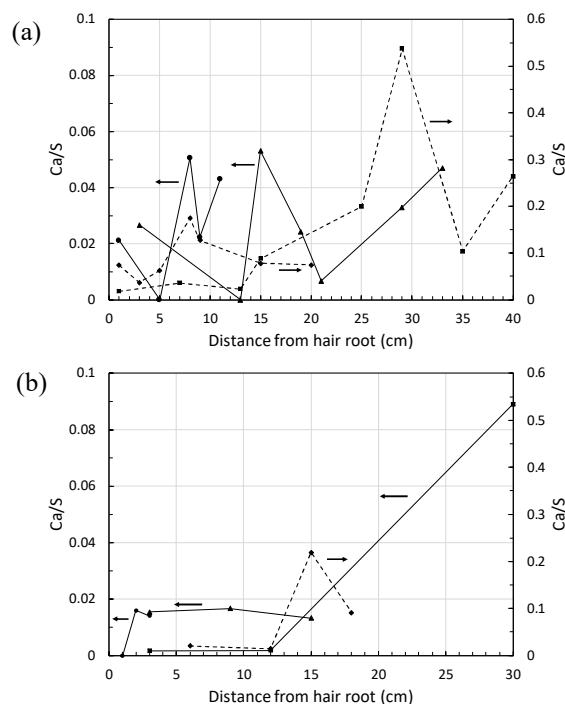


Fig. 1. Ca content in medulla of human hair. (a) breast cancer patients, (b) normal females.

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### References

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