

# Small-Angle Neutron Scattering Study on Hydrated Short Lamellar Structure in Mammal's Skin Stratum Corneum

H. Takahashi (A), N. Kunizawa (B), Y. Obata (C), N. Ohta (D), I. Hatta (E)  
(A) Gunma Univ., (B) Shiseido Co., Ltd., (C) Hoshi Univ., (D) SPring-8/JASRI (E) Fukui Univ. Tech.

## INTRODUCTION

In mammals, the permeability barrier that restricts excess water loss is maintained by multilamellar structure membranes localized in the intercellular space of the stratum corneum (SC), the outmost layer of the epidermis. The multilamellar structures in SC are classified mainly into long and short lamellar structures with repeat distances of about 13 and about 6 nm, respectively. In certain species, however, the short lamellar structure is not observed by X-ray diffraction. The problem whether both long and short lamellar structures exist universally in all mammal's SC remains unsolved. Ohta et al. [1] have proposed that the SC permeability barrier function depends mainly on the short lamellar structures. Thus, from the viewpoints of the barrier function, the universality of short lamellar structure existence is an important problem.

One of advantages of neutron scattering techniques as compared to X-ray techniques is that one can change contrast of samples by using isotope substances. It is believed that there are water layers in the short lamellar structures in SC. Thereby, it is expected that the contrast of SC sample can be enhanced by treating with D<sub>2</sub>O, and that, even in undetectable cases by X-ray techniques, the short lamellar structures can be clearly detected by using small-angle neutron scattering (SANS) techniques.

## EXPERIMENTAL

The SC samples used in this study were prepared from three different animals, i.e., rat, mouse, and pig. According to the method reported in [1], SC was sepa-

rated from a skin. All samples were dried initially and then soaked in 100% D<sub>2</sub>O. The water (D<sub>2</sub>O) contents of the samples were determined by measuring the weight. SANS measurements were performed with the SANS-U spectrometer, (C1-2, JRR3M in ISSP, Tokai, Univ. of Tokyo). The wavelength of the neutron beam was 0.7 nm and two different camera lengths (1m and 4m) were used.

## RESULTS AND DISCUSSION

Figure 1 shows SANS profiles from pig SC sample containing 40% water (D<sub>2</sub>O). A weak but relatively sharp diffraction peak is observed around  $Q = 1.0 \text{ nm}^{-1}$  from 25 °C to 45°C. Judging from the spacing, the peak corresponds to the short lamellar structure. For other animal samples, such peak was not observed. To get further detailed information on the short lamellar structure, we are planning to perform contrast variation experiments.

[1] N. Ohta, S. Ban, H. Tanaka, S. Nakata and I. Hatta, *Chem. Phys. Lipids* vol. 123 (2003), pp. 1-8.

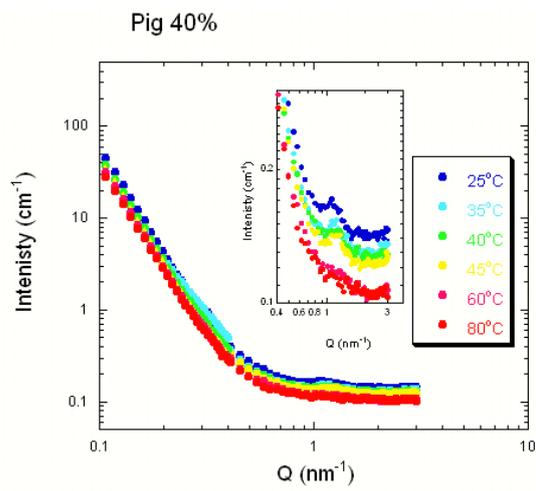


Fig. 1. SANS profiles of pig SC sample.