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Spectroscopic Study of Second Harmonic Generation Chiral Microscopy in Type I Collagen

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Chiral molecules have different efficiencies in generating second-harmonic generation signal for left- and right-circular-polarized light. This effect is called second-harmonic generation circular dichroism (SHG-CD). It has been shown that SHG-CD exhibits much better chiral contrast than traditional chiroptical spectroscopies [1]. Furthermore, combined with a laser scanning microscope, SHG-CD provides optical sectioning capability that is suitable for examining thick tissue samples. We have shown that type I collagen gives rise to strong second-harmonic generation circular dichroism (SHG-CD) responses [2]. However, to resolve the molecular structures and chiral properties of biological tissues, it is not enough to study SHG-CD for only one specific wavelength.

Here, we measured SHG chiral microspectroscopy of type-I collagen in the excitation spectral range of 750 – 1300 nm, for the first time. The result is shown in Figure 1. It is interesting to note that maximum SHG-CD value corresponds to the wavelength of 900nm. This wavelength dependency not only reflects the resonance frequency of the molecular structure, but also the micro-chiral property of type I collagen. Our investigation constitutes an important landmark towards a realistic SHG-CD chiral spectroscopic technique and will make great impact for protein chirality study in three-dimensional tissue samples.

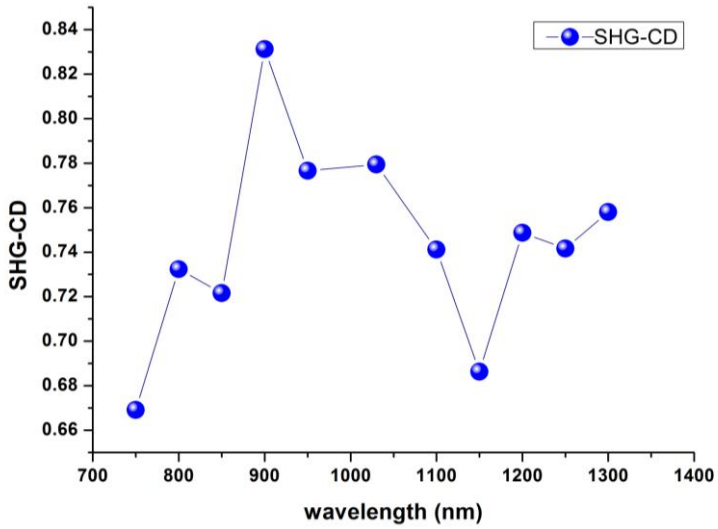

Figure 1: SHG-CD value varies with the excitation wavelength from 750 to 1300nm.

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[2] H. Lee, M. J. Huttunen, K. K. Hsu, M. Partanen, G. Y. Zhuo, M. Kauranen, and S. W. Chu, "Chiral imaging of collagen by second-harmonic generation circular dichroism," *Biomed. Opt. Express*, **4**, 909-916 (2013).