

### **Non-invasive Raman spectroscopy measurement of human carotenoid status**

**Carsten R. Smidt<sup>1</sup>**, Werner Gellermann<sup>2</sup>, Jeffrey A. Zidichouski<sup>1</sup>. <sup>1</sup>Pharmanex Research Institute, 75 West Center Street, Provo, UT 84601, <sup>2</sup>Dept. of Physics, University of Utah, Salt Lake City, UT

Carotenoids are an important group of dietary antioxidants with many health benefits. Serum or plasma carotenoid measurements are commonly used to assess human carotenoid status and to monitor reported intake of fruits, vegetables and dietary supplements. Recently, a Raman spectroscopy (RS) method was developed to safely assess skin carotenoids non-invasively (Biophotonic Scanner, Pharmanex). To help validate this method, 104 healthy adults (64 men, 40 women) were recruited for this study. After an overnight fast, each subject provided a blood sample, and skin carotenoids were assessed at the palm of the hand using RS (473 nm excitation). Blood serum was analyzed for carotenoids by HPLC. Results show a highly significant correlation between serum total carotenoids and skin carotenoids as assessed with RS ( $r = 0.78$ ,  $p < 0.001$ ). Mean serum total carotenoid concentration was 1.44 mcg/ml (range: 0.37 – 3.36) and the mean Raman response for skin measurements was 28,808 counts (range: 14,524 – 56,298). Among individual carotenoids, correlations were strongest for beta-carotene, followed by alpha-carotene, lutein/zeaxanthin, lycopene and beta-cryptoxanthin. Based on these results, RS is able to estimate serum total carotenoids with a variability of +/- 10 % and 95 % confidence. This high correlation between serum and skin carotenoid measurements helps validate RS as a novel, non-invasive, rapid, and field-usable tool to assess human carotenoid status. Supported by Pharmanex, LLC.