UV-induced modifications in Collagen fibers molecular structure: a fluorescence spectroscopy and microscopy study

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Collagen is one of the main components of human connective tissue (skin, bone, and tendons) and its organization and cross-linking status it is known to be at the basis of physical properties and function of these tissues.

We here present an experimental study based on spectroscopy and non-linear imaging focused at highlighting the effects of UV irradiation on collagen fibers (type I). The aim is to analyze UV-induced collagen photo degradation, which is known to be involved in premature skin aging and in the onset of pathological conditions. Bulk analysis reveals that collagen autofluorescence is strongly modified by UV-irradiation leading to the degradation of the native fluorescent species and to the rising of a small fluorescent band centered at 450 nm that could be related to the oxidation product of tyrosine residues.

To better analyze these modifications effect, we also took advantages of the use of ANS, a well-known fluorescent probe, that is known to bind to collagen fibers and whose fluorescence depends on peculiar properties of the environment. Bulk measurements are combined with nonlinear imaging, through the use of second harmonic generation and two-photon FLIM of ANS. Results indicate that UV-exposure modifies collagen supramolecular organization inducing critical modification in ANS binding sites reducing their overall affinity.