Self-assembly of type 1 collagen: Interaction between normal and mutant collagen

SEJIN HAN, WOLFGANG LOSERT, University of Maryland — We investigate the self-assembly of type 1 collagen, termed fibrillogenesis. Fibrillogenesis of type I homozygous mutations revealed a substantial difference in the kinetics, in particular, rapid growth of fibers and the absence of lag time. We developed a technique for differential fluorescent labeling of collagen combined with laser scanning confocal microscopy for time dependent observation of fibrillogenesis kinetics and structural properties in 3D. We observed that co-assembly of heterotrimmers (normal) and homotrimmers (mutant) in mixtures within the same fibrils during fibrillogenesis, despite their very different fibrillogenesis kinetics. Turbidity measurements of fibrillogenesis of mixture of hetero- and homotrimmers showed the normal S-shaped curve with a lag time typical of heterotrimmers. We characterized the structural topology of the collagen 3D network through Betti numbers that are primarily describing the connections between different components. We found that homotrimmers has fewer intersections per disjoint fiber than normal heterotrimmers, demonstrating finer and straighter network structure in images.