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Cryo-imaging and modeling of the super molecular structure of cross-linked gelatin and its applications. CLEMENT MARMORAT, State Univ of NY- Stony Brook, ARKADI ARINSTEIN, Technion Israel Institute of Technology- Mechanical Engineering, NAAMA KOIFMAN, YESHAYAHU TALMON, Technion Israel Institute of Technology- Chemical Engineering, EYAL ZUSSMAN, Technion Israel Institute of Technology- Mechanical Engineering, MIRIAM RAFAILOVICH, State Univ of NY- Stony Brook — The need for naturally derived materials to synthetize bio-compatible scaffolds is growing. In its natural state, gelatin derives its properties from a network of structured, intertwined, triple helical chains. The mechanical properties can be further controlled by additional enzymatic cross-linking. But, in contrast to simple polymer systems, the response to an imposed deformation is then determined by two competing factors, the establishment of the cross-linked mesh vs. the self-assembly of the fibrils into larger and therefore stronger hierarchical structures. Properties deduced from the response functions to measurements; such as rheology or swelling, are then a combination of these two very different factors, hence impossible to model unless more precise knowledge is available regarding the internal structure. We applied cryogenic-temperature scanning electron microscopy (cryo-SEM) to image the networks. Based on these images, a theoretical model was developed, for which we obtained excellent agreement for the mesh size of both networks, and their mechanical properties. We then used these controlled scaffolds, embedding them with fluorescent beads, to image live cells traction forces at stake during cell migration.

Clement MARMORAT
State Univ of NY- Stony Brook

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