Recent publications

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Nano-coating protects biofunctional materials

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The demand to develop convergent technology platforms, such as biofunctionalized medical devices, is rapidly increasing. However, the loss of biological function of the effector molecules during sterilization represents a significant and general problem. The most common sterilization procedures for bio-functionalized medical devices (e.g., implants) for clinical use[1-3] are β-irradiation (electron beam), γ-irradiation, and ethylene oxide (EtO) gas sterilization.

However, these procedures might lead to high energy transfer and altered protein folding attributable to loading shifts, redistribution of charges within the protein, loss of hydrogen bonds, and cleavage of covalent bonds within the protein[4-8]. Especially with β- and γ-irradiation, the presence of oxygen radicals[7,9] and the high energy transfer may lead to unfolding and aggregation of the protein. Therefore, new approaches to avoid sterilization-mediated damage of bio-functionalized materials are urgently needed. We have developed a nano-coating (NC) procedure for the stabilization and protection of biofunctionalized materials. NC is devoid of sugars, sugar alcohols, and proteins which are commonly used as

an excipient in pharmaceutical liquids and freeze-dried formulations[10-13], but do not inhibit sterilization-mediated protein denaturation. By contrast, the NC solution comprises biocompatible small molecules and glycyrrhicic acid that form a protection layer on the surface of the biofunctionalized material after drying.

As a proof of concept, the NC preserved the structural and functional integrity of an otherwise highly fragile antibody immobilized on polyurethane during deleterious sterilizing irradiation ($\geq$25 kGy). The NC procedure enables straight-forward terminal sterilization of bio-functionalized materials while preserving optimal conditioning of the bioactive surface.