Biocompatible gold nanoparticles for wound healing and regenerative medicine

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In biomedical applications, the biocompatibility of gold nanoparticles (AuNPs) is essential due to their utilization in various fields such as drug delivery, photothermal therapy, and diagnostic procedures. To enhance their biocompatibility, GNPs can be integrated with biological substances. Here, we functionalized GNPs with type I collagen (Collagen-I@AuNPs) and used them to facilitate wound healing. Our research demonstrated that Collagen-I@AuNPs decreased the production of interleukin-6 (IL-6) and tumour necrosis factor-alpha (TNF-α) in scratched human skin fibroblast (HSF) cells. Additionally, we observed that Collagen-I@AuNPs stimulated the production of basic fibroblast growth factor (bFGF), which is a key growth factor in wound healing.[1] As a result, Collagen-I@AuNPs accelerated the closure of wounds. Silk sericin, with its notable biological characteristics, serves as an additional illustration of biological substances capable of combining with AuNPs. Silk sericin was used as a reducing and stabilizing agent to produce AuNPs (called AuNPs@SC). We investigated the effect of AuNPs@SC on osteogenic differentiation in mouse mesenchymal stem cells (mMSCs). Our findings indicate that AuNPs@SC at concentrations up to 100 µg/mL exhibited no cytotoxicity to mMSCs. Moreover, AuNPs@SC at a concentration of 25 µg/mL demonstrated the capacity to enhance the production of osteogenic differentiation biomarker levels in mMSCs. Upon immobilization of AuNPs@SC on the surface of polymethyl methacrylate (PMMA), a reduction in surface roughness was observed, and mMSCs demonstrated the ability to adhere and proliferate on the modified surface.[2]

References:
[1] Poomrattanangoon, S.; Pissuwan, D. *Heliyon* **10**, *13*, e33302.
[2] Kasemsuk, N.; et al. *Applied Surface Science* **681**, 161591.