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Parkinson's disease therapy with gold nanoparticles: Advances in drugs biodistribution, nanozyme activity and toxicity

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Parkinson's disease (PD), the second most common neurodegenerative disorder, impacts around 1% of individuals aged 60-65. Characterized by a silent presymptomatic phase, PD progresses with the loss of dopaminergic neurons in the substantia nigra and the formation of Lewy bodies containing misfolded alpha-synuclein. This neuronal degeneration leads to a reduction in dopamine levels, resulting in motor symptoms such as bradykinesia and rigidity, as well as non-motor symptoms including depression, anxiety, and cognitive impairments.
Current PD treatments face challenges like poor brain penetration, unfavorable pharmacokinetics, and limited bioavailability. Reformulation of drugs in NPs presents a promising solution to address these challenges in PD therapy. Nanoparticles enhance drug distribution, provide protection, ensure targeted delivery, and possess theranostic potential, combining therapeutic and diagnostic capabilities in one platform.
Gold nanoparticles (AuNPs) have recently emerged as an innovative treatment option. They mimic natural enzyme activities, such as those of superoxide dismutase, catalase, and peroxidase, and facilitate the conversion of NADH into NAD+, a critical component in cellular energy metabolism. In preclinical studies, AuNPs have demonstrated the potential to improve motor functions and promote remyelination. Their unique optical properties are also being explored for sensitive and advanced detection systems. This review focuses on the role of gold nanoparticles in novel PD therapies.

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