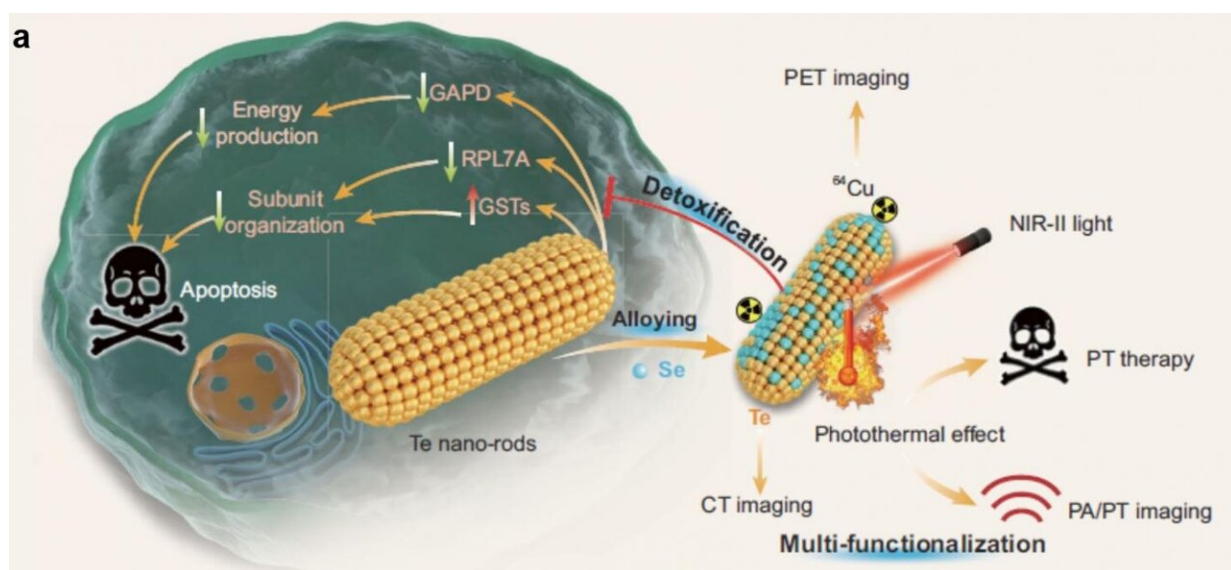


Biocompatible TeSex nano-alloys for PT/PA/CT/PET imaging-guided NIR-II-photothermal therapy

August 31 2020



Schematic illustration of TeSex alloying strategy and mechanisms for detoxification and theranostic multi-functionalization. Credit: Science China Press

Nanotheranostics, integrating diagnostic and therapeutic functions by nanoplatform, exhibits a great potential in precision and personalized medicine, and also raises the requirement on multifunctional nanomaterials in pursuit of both good biocompatibility and high theranostic performance.

The emergence of diverse multifunctional nanomaterials and advanced nanotechnologies unprecedentedly simulates the evolution of nanotheranostics, and enables the integration of multimodal imaging and therapeutic functions in a single theranostic nanoparticle for high-efficacy theranostics of diseases. In engineering of theranostic nanoplatforms, biocompatibility and multifunction are two most important factors which need to be considered. Among various nanotheranostics, multimodal imaging-guided photothermal therapy has attracted intensive attention owing to its less invasiveness and lower side effects compared with conventional radiotherapy and chemotherapy.

In a new article published in the Beijing-based *National Science Review*, scientists in Shenzhen University, China, hypothesize that controllable incorporation of the biocompatible Se element into the lattice of Te nanostructures for construction of TeSex nano-alloys could intrinsically tune the inherent cytotoxicity of Te nanomaterials, enhance the biocompatibility of Te nanomaterials and extend their functions for biomedical applications. In this work, a series of TeSex nano-alloys with different Se incorporating proportions are synthesized to investigate their biocompatibility and develop their theranostic functions.

It has been determined that the toxicity of Te nanomaterials mainly comes from irreversible oxidation stress and intracellular imbalance of organization and energy, which is exterminated by the nano-alloying by incorporating a moderate proportion of Se ($x=0.43$). The synthesized TeSex nano-alloy exhibits extraordinarily high NIR-II-photothermal conversion efficiency (77.2%), ^{64}Cu coordination and CT contrast capabilities, enabling high-efficacy [photothermal therapy](#) of cancer under the guidance of multimodal PT/PA/PET/CT imaging.

Several main advances have been achieved. Firstly, advanced TeSex nano-alloys may be facilely constructed to intrinsically eliminate the inherent toxicity of Te nanomaterials by the moderate incorporation of

biocompatible Se. Secondly, advanced mechanisms for Te [nanomaterial](#) toxification and TeSex alloying detoxification were uncovered. Finally, advanced [theranostic](#) performance with ordinarily high NIR-II-photothermal efficiency and multimodal PT/PA/CT/PET imaging capability have been achieved by the proposed nano-alloying strategy.

More information: Xiang Ling et al, Engineering biocompatible TeSex nano-alloys as a versatile theranostic nanoplatform, *National Science Review* (2020). [DOI: 10.1093/nsr/nwaa156](https://doi.org/10.1093/nsr/nwaa156)

Provided by Science China Press

Citation: Biocompatible TeSex nano-alloys for PT/PA/CT/PET imaging-guided NIR-II-photothermal therapy (2020, August 31) retrieved 23 May 2024 from <https://phys.org/news/2020-08-biocompatible-tesex-nano-alloys-ptpactpet-imaging-guided.html>

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