Nature-inspired all-in-one platform to avoid the persistence of metal nanoparticles in cancer theranostics

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Noble metal nanostructures have demonstrated a number of intriguing features for applications to various diseases, and in particular for innovative treatments of neoplasms.[1] Nonetheless, there is still no clinically approved noble metal nanomaterial for cancer therapy/diagnostic. The clinical translation of noble metal nanoparticles (NPs) is mainly prevented by the issue of persistence in organism after the medical action. Such persistence increases the likelihood of toxicity and the interference with common medical diagnoses. Size-reduction to ultrasmall nanoparticles (USNPs) is a suitable approach to promote metal excretion by the renal pathway.[1] However, most of the functionalities of NPs are lost or severely altered in USNPs, jeopardizing clinical applications.

A groundbreaking advance to jointly combine the appealing behaviors of NPs with metal excretion relies on the ultrasmall-in-nano approach.[1] Within this approach, we have designed inorganic all-in-one degradable nano-platforms comprising USNPs: the nature-inspired passion fruit-like nano-architectures.[2–4] Such nano-architectures might lead to the delivery of a novel paradigm for nanotechnology, enabling the translation of noble metal nanomaterials to clinics in order to treat carcinomas in a less invasive and more efficient manner.[1,5] The last achievements from this novel approach will be discussed together with the next exciting perspectives.

This work is supported by the MFAG number 19852 from Associazione Italiana per la Ricerca sul Cancro (AIRC) granted to VV.

References:

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Short bio:

Valerio Voliani is a researcher at Center for Nanotechnology Innovation (CNI) @NEST, Istituto Italiano di Tecnologia. He has obtained the MSc in Chemistry and the PhD in Molecular Biophysics from Scuola Normale Superiore (Pisa, Italy). His efforts are devoted in filling the gap between inorganic nanomaterials and clinical applications by addressing the issue of metal persistence after the designed action. By applying the “ultrasmall-in-nano approach”, he has recently developed the “passion fruit-like nano-architectures”: an all-in-one inorganic nanomaterial able to jointly combine most of the intriguing behaviors of metal nanoparticles with their excretion from organism. He is also actively engaged in the development of innovative nanocatalysts for automotive exhaust gas treatment and environmental remediation.