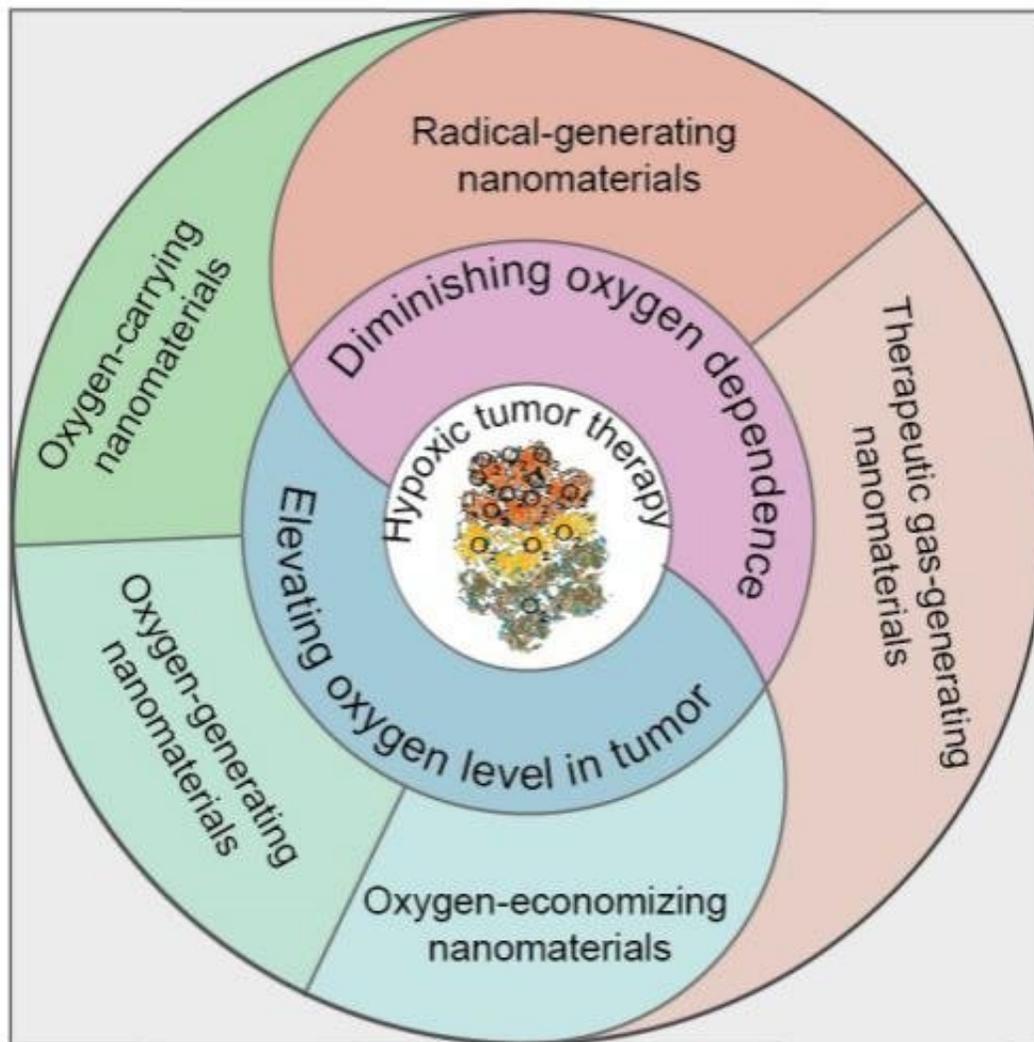


Nanomaterials based strategies for treatment of hypoxic tumor

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Schematic illustration of strategies for treatment of hypoxic tumor with nanomaterials. Credit: ©Science China Press

Hypoxia is a typical characteristic of most tumors, owing to the fast consumption of oxygen by tumor tissue over the supply through malformed and abnormal tumor vasculature. Hypoxia in tumor tissue promotes the probability of tumor metastasis and endows hypoxia-tolerant tumor cells with resistance to some tumor therapies, including chemotherapy, radiotherapy, photodynamic therapy, and immunotherapy.

Nanomaterials have been rapidly developed, which opens up new areas in biomedical applications. Nanomaterials equipped with drugs are easier to accumulate in tumor tissues compared with [small molecules](#). Also, nanomaterials are easily modified and armed with enhance multi-functions, which is favorable for tumor therapy.

One strategy is to directly elevate the [oxygen level](#) in [tumor tissues](#). Oxygen-carrying nanomaterials, oxygen-generating nanomaterials, and oxygen-economizing nanomaterials are utilized to relieve the hypoxic tumor environment. As the oxygen level elevates in the tumor site, the resistance to tumor therapies of hypoxia-tolerant tumor cells is reduced and the tumor therapies are more effective.

Another strategy is to diminish oxygen dependence. It is readily comprehensible that therapies independent of oxygen are powerful weapons to treat hypoxic tumors. Free radicals are substances with strong oxidizing properties, which can induce cell death. Radical-generating nanomaterials can be used to treat tumors with oxygen dependence. Besides, some gaseous molecules play an essential role in physiological modulation, and therapeutic gas-generating nanomaterials can control the delivery of gas for hypoxic tumor therapy.

In a new overview published in the Beijing-based *National Science Review*, scientists at Wuhan University and South-Central University for Nationalities, China, present the latest advances on nanomaterials for the

treatment of hypoxic tumors. Xian-Zheng Zhang et al. summarized nanomaterials for treatment of hypoxic tumor with different strategies: 1) Elevating oxygen levels in tumors by nanomaterials (oxygen-carrying nanomaterials, oxygen-generating nanomaterials, oxygen-economizing nanomaterials) for enhanced oxygen-dependent tumor therapy and 2) diminishing oxygen dependence of nanomaterials (therapeutic gas-generating nanomaterials and radical-generating nanomaterials) for hypoxic tumor therapy are reviewed.

They also outlined the potential development direction of future nanomaterials for treatment of hypoxic tumors. "Oxygen-carrying nanomaterials or oxygen-generating nanomaterials are difficult to use in continually alleviating the hypoxia for tumor therapy," Zhang said. "It is necessary to develop nanomaterials with controllable and sustained release of oxygen in a tumor site, which may be favorable for synergistic therapy."

More information: Mei-Zhen Zou et al, Advances on nanomaterials for treatment of hypoxic tumor, *National Science Review* (2020). [DOI: 10.1093/nsr/nwaa160](https://doi.org/10.1093/nsr/nwaa160)

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