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## IMMUNE SYSTEM UPGRADE: CATALYTIC IMMUNOTHERAPY FOR CANCER: NANOPARTICLES ACT AS ARTIFICIAL ENZYMES

**OCTOBER 25, 2019** - Theoretically, our immune system could detect and kill cancer cells. Unfortunately, tumors are well armed to fight these attacks. Despite modern cancer treatments, metastases and relapses remain a major problem. Increasing anti-tumor immunity might now be made possible, thanks to copper telluride nanoparticles that mimic enzymes, especially under NIR-II light irradiation. This induces oxidative stress in tumor cells, quashing their immunosuppressive status and triggering inflammatory processes, as Chinese scientists report in the journal *Angewandte Chemie*.

Immune System Upgrade: Catalytic immunotherapy for cancer: nanoparticles act as artificial enzymes  
So-called “Nanoenzymes” are hot candidates for treatments called “catalytic immunotherapy”. These nanoparticles have structures completely different from biological enzymes but mimic the enzymes’ catalytic activity. They are easier to prepare than natural enzymes, as well as being less expensive and more stable.

Researchers working with Wansong Chen and You-Nian Liu at Central South University (Changsha, Hunan, China) have now introduced a new nanoenzyme: copper telluride nanoparticles ( $\text{Cu}_{2-x}\text{Te}$ ) mimic the activities of the enzymes glutathione oxidase and peroxidase. The activity of this nanoenzyme is due to the copper ions, which switch between two oxidation states. The substrate is glutathione, an antioxidant that is found in significantly higher concentrations in tumor cells than in healthy ones. This is why the nanoenzymes are only active in tumor cells. In addition, they absorb NIR-II light (near-infrared light with a wavelength between 1000 and 1350 nm), causing their local environment to heat up. This effect strongly increases the enzyme-like activity of the nanoenzymes. In treatment, the NIR-II irradiation could be selectively applied to the tumor.

Experiments in tumor-cell cultures and with tumor-bearing mice demonstrated that use of the nanoenzymes and NIR-II irradiation triggers a whole cascade of cellular responses that greatly increase the oxidative stress within the tumor, which ultimately leads to cell death. At the same time, the suppression of immunological processes in the microenvironment around the tumor is lifted. Instead, substances

that promote inflammation are released and an immune response is triggered. This is supported by the elevated concentration of effector T cells observed by the researchers. The immune system is thus able to learn to defend itself against metastasis and to build an “immunological memory” to prevent relapses.

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## EXERCISE CAPACITY MAY AFFECT COGNITIVE HEALTH OF SURVIVORS OF CHILDHOOD LEUKEMIA

**OCTOBER 21, 2019** - A new study found a link between reduced exercise capacity and neurocognitive problems in survivors of acute lymphoblastic leukemia (ALL), the most common childhood cancer. The findings are published early online in *CANCER*, a peer-reviewed journal of the American Cancer Society.

Survivors of childhood ALL are at increased risk of experiencing neurocognitive deficits and reduced exercise capacity due to their disease and its treatment. A team led by Kirsten Ness, PhD, and Nicholas Phillips, MD, PhD, of St. Jude Children’s Research Hospital in Memphis, Tennessee, looked for an association between these outcomes by examining exercise and neuropsychological test results, as well as questionnaire answers, from 341 adult survivors of childhood ALL and 288 healthy controls. The researchers measured how much physical activity survivors could tolerate and how that related to their ability to think, learn, memorize, read, and do math.

Compared with controls, survivors had worse cardiovascular fitness and poorer performance on neuropsychological tests, including those related to attention, memory, and academic skills. After adjusting for age, sex, radiation and chemotherapy treatments, smoking status, and physical activity, the authors found that increases in exercise capacity were associated with better performance on various neuropsychological tests among survivors.

Previous studies in children and older adults without cancer suggest that physical fitness can provide benefits to brain function and academic performance. Results from the current study indicate that such benefits might also be experienced by children with cancer who need potentially neurotoxic anticancer treatments.

“Our research suggests that a minor improvement in exercise tolerance, such as going from sitting on the couch and watching TV to walking around the block for 30 minutes a day, can have a significant impact on survivors’ intellectual health,” said Dr. Phillips. “We know that memory and thinking skills decline as we age. Any improvement in exercise tolerance, even in adulthood, may have an impact on a survivor’s ability to think, learn, and memorize,” added Dr. Ness.