Polymer Nanoparticle Kills Tumors

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Photodynamic therapy (PDT), which uses a light-sensitive chemical known as a photosensitizer to produce cell-killing “reactive oxygen,” has become an important option for the treatment of esophageal cancer and non-small cell lung cancer. Current photosensitizers, however, produce significant side effects, including sensitivity to the sun, that limits their wider use in treating cancer.

In an attempt to both eliminate those side effects and increase the anticancer activity of photosensitizers, a multi-institutional research team led by Ralph Weissleder, M.D., co-director of the MIT-Harvard Center of Cancer Nanotechnology Excellence, has developed a polymer nanoparticle to ferry photosensitizers into cancer cells, where they can then unleash their potent cell-killing effects. The investigators report their work in the journal Nano Letters.

Dr. Weissleder and his colleagues created nanoparticles from a biodegradable polymer known as poly(lactic-co-glycolic acid), and used these nanoparticles to encapsulate a photosensitizer designed to aggregate, or clump together, within the nanoparticle. Such aggregation prevents the photosensitizer molecules from being activated by light, rendering them non-toxic while circulating in the bloodstream. But once the nanoparticles are taken up by cancer cells, they fall apart and release the photosensitizer molecules, which then disaggregate. As a result, the photosensitizers become active once more and can kill cancer cells when irradiated with light. When stored in the dark at room temperature, the nanoparticle-photosensitizer formulation is stable for 6 to 12 months.

Experiments using cancer cells grown in culture dishes showed conclusively that the nanoparticle-photosensitizer formulation had little toxicity to cells unless taken up within the cells. The investigators also conducted tests in which they injected this formulation into tumor-bearing mice and then administered light therapy 24 hours later. This experiment confirmed that the nanoparticle-borne photosensitizer accumulated in tumor cells and was capable of killing those cells when exposed to light.

This work, funded in part by the National Cancer Institute, is detailed in a paper titled, “Polymeric nanoparticle preparation that eradicates tumors.” Investigators from the University of Connecticut and the University of Central Florida also participated in this study. An abstract is available through PubMed.

Source: National Cancer Institute

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