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Editorial

Nano-Photosynthesis: An Eye-Opening Concept for Stroke Therapy

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EDITORIAL

Stroke patients' brains have blocked blood veins, preventing oxygen-rich blood from reaching cells and causing serious damage. Photosynthesis is the process through which plants and some microorganisms create oxygen. What if there was a way to induce photosynthesis in patients' brains? In a proof-of-concept study, researchers used blue-green algae and unique nanoparticles to do just that in cells and mice.

According to the World Health Organization, 5 million people die each year as a result of strokes. Millions more survive, but they frequently suffer from infirmities like as speech, swallowing, or cognitive issues. A blood vessel blockage in the brain is the most common cause, and the best method to avoid irreversible brain damage from this type of stroke is to dissolve or surgically alter the blockage as soon as possible. However, those solutions are only effective for a short period of time following a stroke and can be dangerous.

Photosynthesis has previously been used to treat a deficiency of oxygen in cardiac tissue and malignancies using blue-green algae like Synechococcus elongatus. However, visible light is unable to trigger the microorganisms, and while near-infrared light can pass through, it is insufficient to fuel photosynthesis directly. Up-conversion nanoparticles absorb near-infrared photons and release visible light, making them useful for imaging. Scientists wanted to investigate if they could combine these components — S. elongatus, nanoparticles, and near-infrared light — in a new nano-photosynthetic system to develop a new technique that could one day be utilized for stroke victims.

S. elongatus was combined with neodymium up-conversion nanoparticles, which convert tissue-penetrating near-infrared light to a visible wavelength that the microorganisms can employ for photosynthetic purposes. They discovered that the nano-photosynthesis technique reduced the number of neurons that died after being deprived of oxygen and glucose in a cell investigation. The bacteria and nanoparticles were subsequently introduced into mice with restricted cerebral arteries and subjected to near-infrared light. The treatment lowered the amount of dead neurons, enhanced the animals' motor performance, and even aided the formation of new blood vessels. Although this medication is still under animal testing, the researchers believe it has the potential to progress to human clinical trials in the future.

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