NEWS BRIEFS

Gene-based medicine destroys human brain tumor in animal study

Yuan Rui/Johns Hopkins University

Researchers at Johns Hopkins University are reporting that they have successfully delivered microRNAs to treat human brain tumors implanted in mice. The findings appeared in *Nano Letters* online on 21 June 2018. The discovery is particularly significant because the team successfully breached the notoriously difficult blood-brain barrier and simultaneously targeted

the glioblastoma tumor with a genetic payload designed to bind messenger RNA linked to two genes—*HMGA1* and *DNMT*—that drive stem cell-like behavior in the cancer cells. Senior author John Laterra, professor of neurology, oncology, and neuroscience, and biomedical engineer Jordan Green teamed to design packets made of biodegradable plastic 1000 times smaller than the width of a human hair that mimic natural components used by cells to communicate. When cancer cells engulf the packets, the packets break apart and release their microRNA “payload.” The scientists implanted human glioblastoma cells into mice. After they had developed tumors, half of the animals received nanopackets containing microRNAs, while the other half received nanopackets with sham microRNAs. Five of the nine mice receiving inactive microRNAs (controls) died within 2 months; the rest of the control mice died within 90 days. All of the control mice had large tumors in their brains when they died. Four of the mice that received active microRNAs and lived to 133 days had no tumors, and two had small ones. “Brain cancer is one of the most widely understood cancers in terms of its genetic makeup, but we have yet to develop a good treatment for it,” said Dr. Laterra. The researchers report that the nanoparticles used in the study can encapsulate multiple types of microRNAs to target multiple gene networks and are able to permeate the entire tumor because rodent brains are small. In humans, with bigger brains, a pump and catheter may be needed to funnel nanoparticles throughout the brain. The team is working to scale up development of its nanoparticles and standardize their stability and quality before beginning clinical trials. —Karyn Hede, News Editor

Mitochondrial transplantation could show promise for infants with cardiomyopathies

Surgeons operating on the tiniest patients have successfully used mitochondrial transplantation to help them overcome the effects of ischemia that can occur in damaged heart cells. Heart surgeon Sitaram Emani is leading a clinical trial at Boston Children’s Heart Center that is credited with saving several children using the unique procedure.

Inborn errors of metabolism and other genetic defects that cause cardiac ischemia, which damages mitochondria and its DNA, cause the heart to weaken and pump blood less efficiently. Typically, children born with severe heart defects are treated with an extracorporeal membrane oxygenation (ECMO) heart-lung bypass machine. The new procedure involves quickly extracting more than 100 million healthy mitochondria from the child’s healthy skeletal muscle cells and then delivering a them into ailing heart muscle. “Within 48 hours of mitochondrial transplantation, we start to see heart function improve in our patients,” said Dr. Emani. “By day four, their heart function has nearly normalized.” The team has treated 11 patients with mitochondrial transplantation. Although three of the patients were too sick to ultimately recover, most of the patients were able to discontinue ECMO and are thriving today. From the clinical trial data, the investigators hope to determine when mitochondrial transplantation should be performed to be the most effective. So far, it appears that the sooner, the better. —Karyn Hede, News Editor

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