MedicalXpress

The brain tumor trap

February 19 2014, by Eileen Brangan Mell

Aggressive brain tumors are usually deadly. The five-year survival rate for patients receiving the best current treatments is typically less than 25 percent. Taking an engineering approach to a potential new treatment, researchers at Georgia Tech and Worcester Polytechnic Institute (WPI) have designed and tested a small device that can lure brain tumor cells into a killing trap without harming the healthy surrounding tissue.

Early results show the new device significantly reduced the size of brain tumors in rats. This potentially game-changing technology for cancer therapy, which could be applied to other cancers in the body not just brain tumors, is reported in the paper "Guiding intracortical brain tumor cells to an extracortical cytotoxic hydrogel using aligned polymeric nanofibers," published February 16, 2014, by the journal *Nature Materials*.

"With growing incidences of cancer, there is a great need for therapeutic strategies to treat aggressive, inoperable brain tumors," said Anjana Jain, PhD, assistant professor of biomedical engineering at WPI, first author of the paper and co-inventor of the tumor trap technology.

The senior author of the paper and co-inventor of the device is Professor Ravi Bellamkonda, PhD, chair of the Wallace H. Coulter Department of Biomedical Engineering at Georgia Tech and Emory University. The new device was first developed by the team while Jain was a post-doctoral fellow in the Bellamkonda lab. She is continuing the research and device development at WPI.

In the current study, Jain and the team worked with the cancer glioblastoma multiforme (GBM), which accounts for nearly half of all human brain tumors. GBM is aggressive and invasive. It often develops in parts of the brain that make it inoperable. Even in cases where the primary tumor can be removed, some of the cancer has usually spread to other locations.

Typically, GBM and other cancers spread by secreting enzymes that break down neighboring healthy tissue. In the brain, they tend to spread along blood vessels and axons. It's a process that requires a significant amount of energy from the tumor cells. "So our idea was to give the tumor cells a path of least resistance, one that resembles natural structures in the brain, but does not require the cancer cells to expend anymore energy," Jain said. "And that's what our study showed. It was a tempting path of least resistance to follow, but it led to the trap that killed the tumor cells."

The device uses tiny fibers engineered to mimic the surfaces of blood vessels and axons. The tips of the fibers are implanted near the brain tumor. At the other end of the device, the fibers lead into a trap filled with a drug that kills only cancer cells. The cancer cells, which are prone to migrate, move along the fibers and get stuck in the trap, where they die. (See animation at right for a rendering of the process.)

Jain's interest in cancer therapeutics began during her graduate research in spinal cord regeneration. In that work Jain and the team at Georgia Tech were developing biomaterials as scaffolds to promote axonal growth into a defect and recapitulate the missing or injured tissues. "The signaling pathways we were trying to activate to repair the spinal cord were the same pathways researchers would like to inactivate for glioblastomas," Jain said. "Moving into cancer applications was a natural progression, one that held great interest because of the human toll of the disease."

More information: For more details: phys.org/news/2014-02-hijack-c… mechanism-brain.html

"Guiding intracortical brain tumour cells to an extracortical cytotoxic hydrogel using aligned polymeric nanofibres." Anjana Jain, Martha Betancur, Gaurangkumar D. Patel, Chandra M. Valmikinathan, Vivek J. Mukhatyar, Ajit Vakharia, S. Balakrishna Pai, Barunashish Brahma, Tobey J. MacDonald & Ravi V. Bellamkonda *Nature Materials* (2014) DOI: 10.1038/nmat3878 .Received 07 October 2013 Accepted 02 January 2014 Published online 16 February 2014