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New method of drug delivery more effective at reaching brain tumors

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Bioengineers at Yale and Cornell have created a modified chemotherapy that more effectively reaches and remains at the site of brain tumors — by adding a water-soluble polymer to the anti-cancer drug, according to a report in the November-December issue of *Bioconjugate Chemistry*.

“This approach has the potential to increase treatment distances to more than a centimeter, which may be sufficient to prevent the recurrence of human brain tumors,” said Mark Saltzman, Goizueta Foundation Professor of Chemical and Biomedical Engineering and senior author on the paper.

Although placing polymer implants directly at the site of tumor is a proven treatment for cancers of the brain, Saltzman says that success of this approach is minimized because in most cases the drug does not penetrate into the brain far enough for optimum treatment and there is rapid clearance of the drug from the site.

To increase the effectiveness of their drug, Saltzman’s team attached polyethylene glycol (PEG), an inert water-soluble polymer, to it. They also identified a promising compound that could deliver 11 times more medication to the tumor than the plain drug alone.

According to Saltzman, previous work on direct delivery of chemotherapy agents to the brain has shown that drug penetration is limited by the low diffusion into tissue. To overcome this limitation, clinical investigators have pumped therapeutic agents at high pressure

into the brain. However, this works only as long as the pressure-driven flow is applied, and the side effects of this continuous pumping are unknown.

“We recently conjugated — or bonded — PEG to the chemotherapy drug camptothecin and found a substantial increase in the extent of distribution of camptothecin in the rat brain,” said Saltzman. “This new method using drug conjugates, which are able to diffuse through tissue and remain in the tissue for prolonged periods, allows them to penetrate significant distances without the need for pressure-driven flows and could substantially improve chances for successful treatment.”

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