

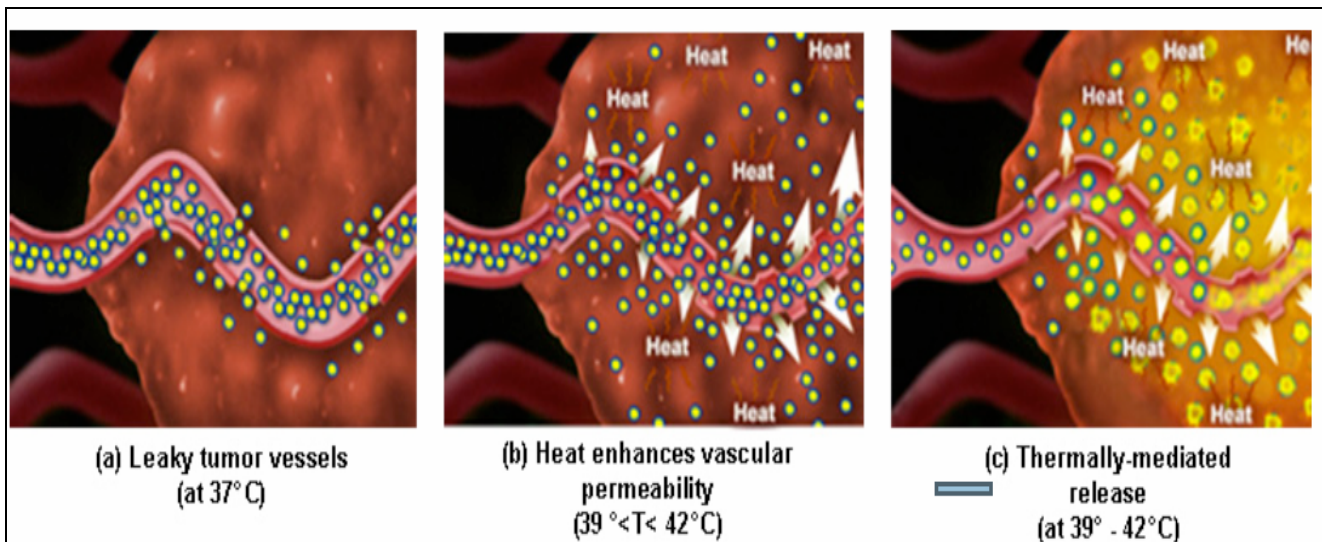
MAGNETIC NANOPARTICLE HYPERTHERMIA INSTRUMENT

--2024--

Magnetic Hyperthermia: (In Vitro / In Vivo Cancer Research)

- (1) Targeting
- (2) Drug Release
- (3) Drug Penetration

Comparative DOX Delivery Paradigms for Heat Responsive Liposomes



Summary: The key difference between the tumor models is vascular permeability. By raising the temperature of the tissue, drug release can occur. Hyperthermia heating increases microvascular permeability and drug infusion by **9-fold**. M. Dewhirst, *NanoScale Drug Delivery and Hyperthermia*, 2011. pp. 38-60

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Magnetic Hyperthermia Breast / Brain Cancer Treatment

Features:

- A. Heating Power: 5.0-10.0 KW /250-450 kHz
- B. Magnetic Power Intensity: (350-1000 Gauss / High SAR values)
- C. Hand-Portable Planar Magnetic Amplifier: 25-40 kA/m
- D. Penetration Depth: 30-55 mm
- E. Scan the Heating over a Wide Area

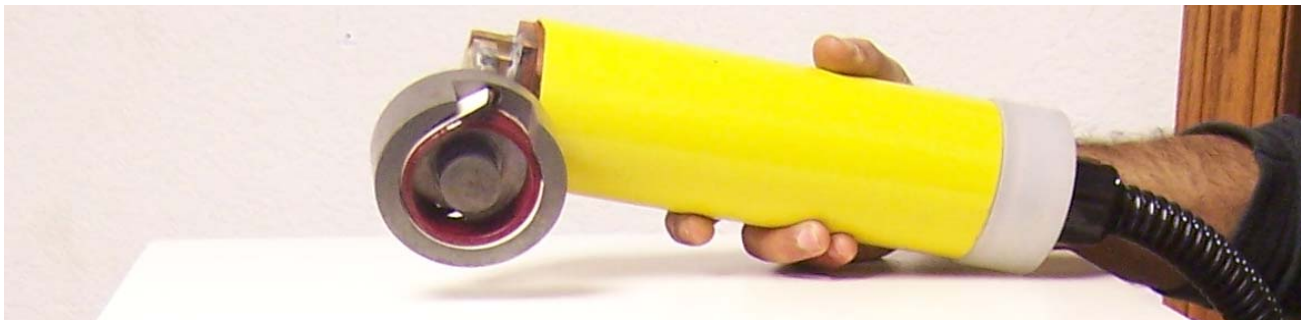


TECHNOLOGY REPORT: The physiology of the tumor is one of the key factors responsible for the failure of chemotherapy: (1) High hydrostatic pressure of tumors and limited blood flow prevents drugs to easily penetrate tumor tissue rich with cancer cells. (2) Cancer cell's cumulative resistance to repetitive drug treatments. (3) Damaging effects of drug toxicity on non-targeted and healthy tissue. (4) Absence of a useful system to remotely trigger the release of the cancer drug specifically at the site of the tumor.

MAGNETIC HEATING of temperature sensitive magnetic nanocarriers allows targeted release of the cancer drug. (P. Pradhan) Further, low temperature heating can improve microvascular permeability of the tumor. This allows the drug to more easily penetrate the cancer tissue and restrict the growth of the tumor. (M. Dewhirst)

Breakthrough in Magnetic Hyperthermia Treatment

HAND APPLICATOR: Cancer research has used magnetic hyperthermia to enhance the effectiveness of chemotherapy. Conventional treatments have been limited to tests with small animals. However, round heating coils are size-restricted and have no practical application for treating human conditions. What researchers now are asking for is a planar coil that can be used on any human body part. A planar coil is flat and can provide deep heating thru the body's abdomen, leg, arm and skull. The Hand Unit is light weight and can be moved around the body's surface to target internal tumors.

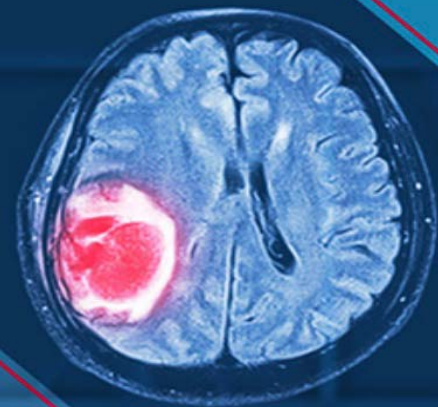


Brain Tumors can be treated with chemotherapy and surgery. But the cancerous lesions are difficult to remove through surgery. Employing nanoparticles and magnetic hyperthermia offers an additional method to stop the spread of the tumor.

Meningiomas

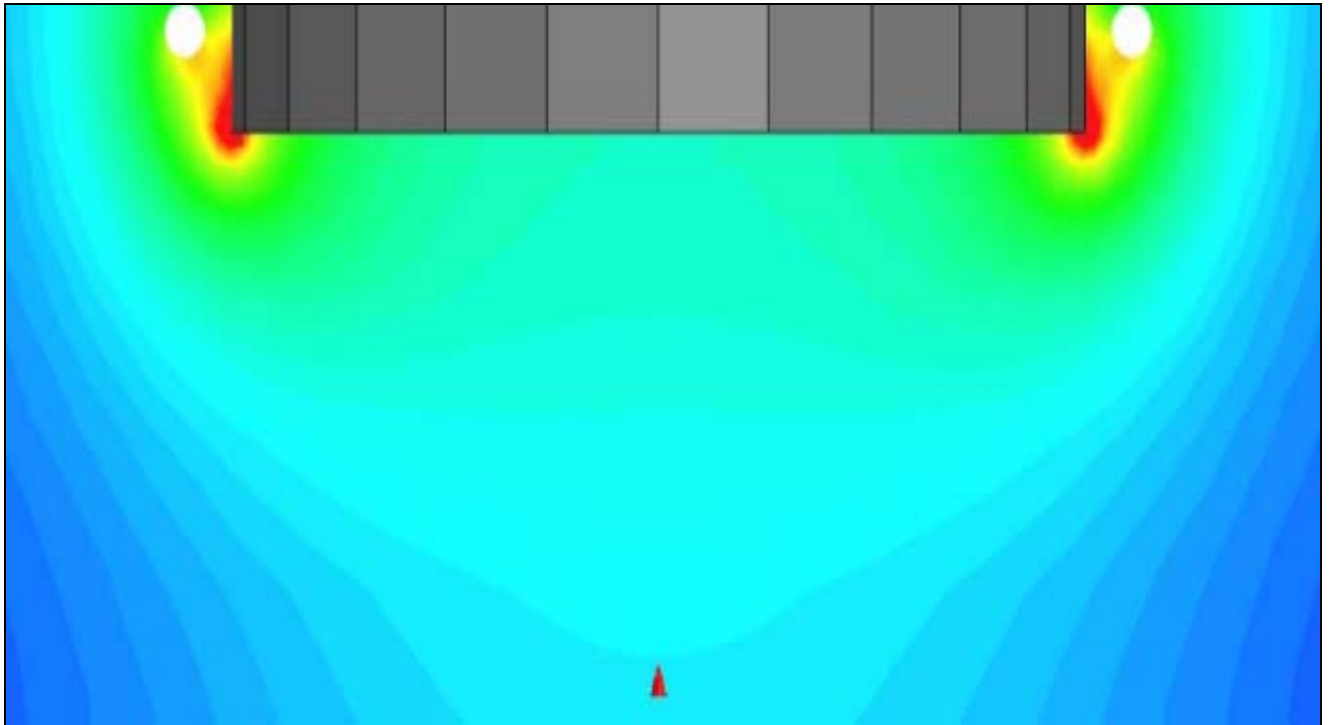
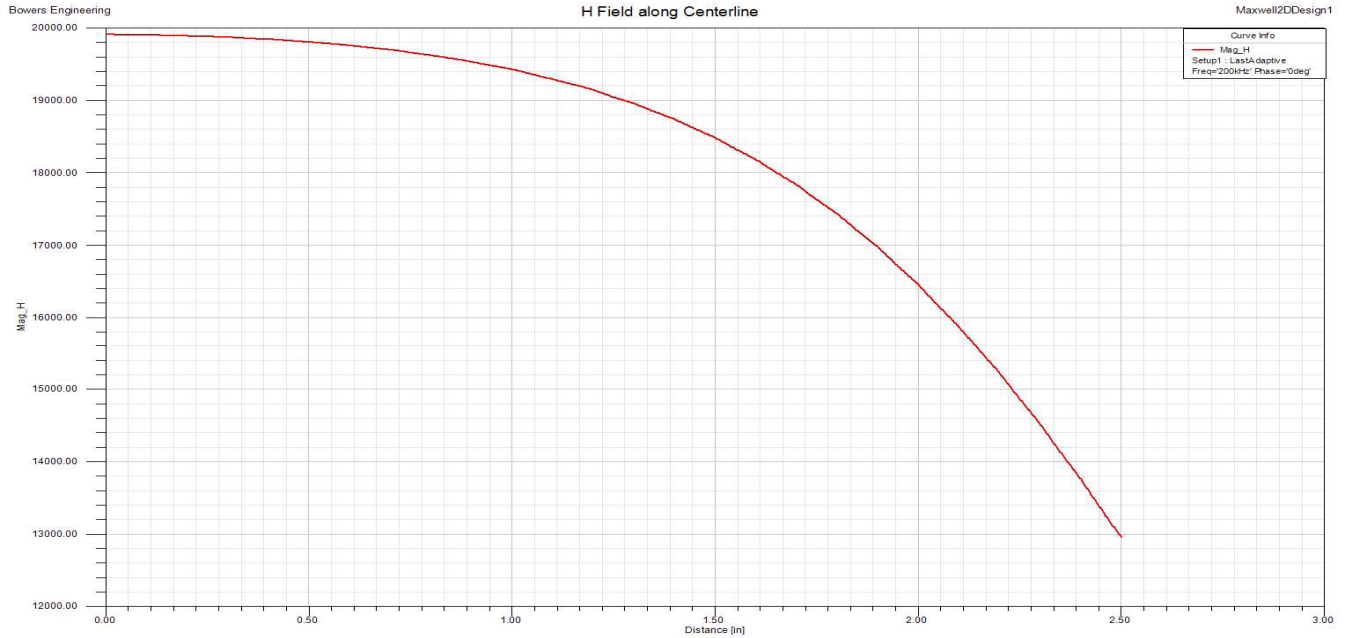
are the most common form of brain tumors.

About 80% of these cases are considered Grade 1, which can usually be cured by surgery.



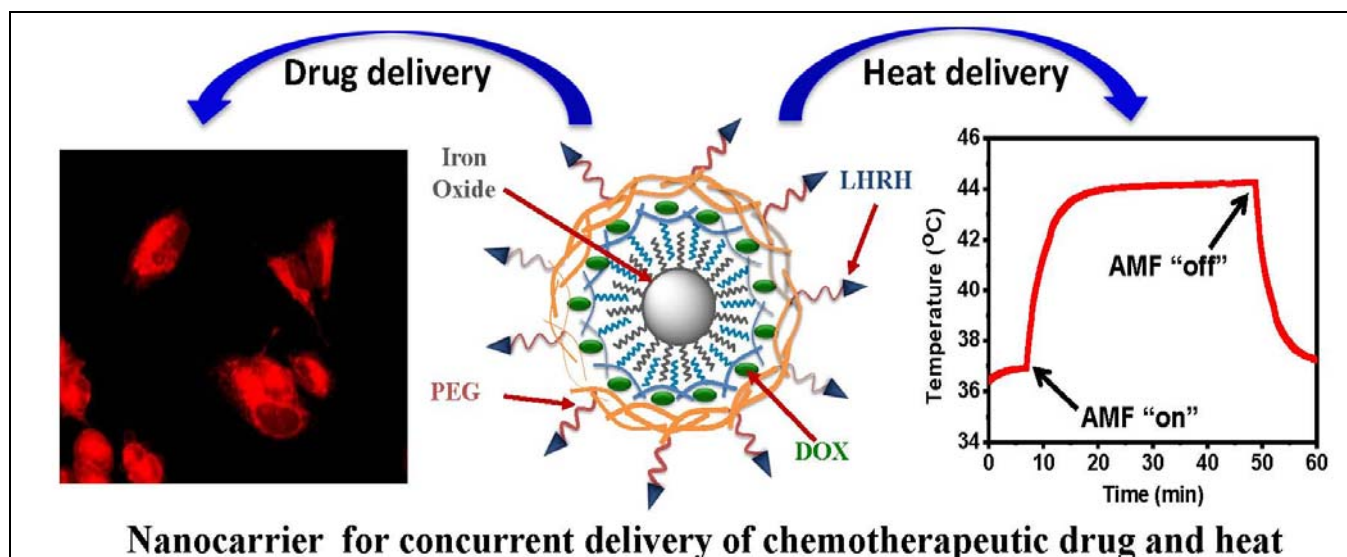
Virtual Heating

Finite element analysis of a high frequency planar coil. The planar coil directs energy in an outward direction. For heating virulent bacteria or heating cancerous tumors, the hand unit can focus the heating in one area or can be moved and scan a wider area. The key is that killing the bacteria is localized, eliminating the need to subject the body to heavy antibiotic treatment that can last for months and still be ineffective.



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MAGNETIC HYPERTHERMIA ENHANCES CHEMOTHERAPY



NANOCARRIER DRUG DELIVERY:

By using operator-controlled magnetic energy to remote-trigger the release of the nanocarrier drug at the tumor site, non-specific (healthy) tissue is protected from the toxic effects of chemo. Further, the heating of the nanoparticles and surrounding tumor tissue improves the permeability of the tumor tissue matrix, allowing the drug to more easily penetrate the tumor tissue. The net result is that the chemo therapeutic efficacy is improved, less cancer drug is required and the tumor's resistance to the drug is suppressed.

Taratola, O: *Multifunctional Nanomedicine Platform for Concurrent Delivery of Chemo and Mild Hyperthermia for Ovarian Cancer Cells*, International Journal of Pharmaceutics, 2013, pp. 1-40

PA-17-302) YouTubeVideo: <https://youtu.be/cdLOQ2ZytUU>

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