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New evidence by UAB researchers that specific electromagnetic fields can safely block the proliferation of cancer cells and tumor growth may help refine a new, targeted therapy without any collateral damage.

Very low levels of amplitude-modulated radiofrequency electromagnetic fields block cancer-cell growth in a tumor- and tissue-specific fashion, says Boris Pasche, M.D., Ph.D., director of the UAB Division of Hematology and Oncology. Pasche (pictured, at right) and a research team led by Jacquelyn Zimmerman, graduate student in the UAB Medical Scientist Training Program, conducted studies with cancer cells, replicating the treatment conditions in patients with cancer. The results were published in the Dec.1, 2011, online version of the *British Journal of Cancer*.

The study provides the first laboratory evidence of an effect observed in earlier clinical studies

when cancer cells, exposed to electromagnetic fields emitted by custom-made devices replicating patient-treatment conditions, was found to be blocked by specific modulation frequencies. The new study suggests that fine-tuning field frequency makes the effect specific to certain tissues and tumors and holds clues for how it might work.

Two earlier clinical studies suggested the growth of cancer cells may be altered following exposure to specific frequencies; however, this is the first time an effect has been observed in a laboratory setting, Pasche says.

“We now have laboratory evidence showing a direct effect on cancer cells and providing a plausible mechanism of action based on the modulation frequencies used in patients,” says Pasche. In recent studies, Pasche and his team gathered clinical evidence that very low and safe levels of amplitude-modulated electromagnetic fields may elicit therapeutic responses in patients with advanced liver and breast cancer. “However, until now there was no known mechanism explaining how very low levels of electromagnetic fields might block the growth of cancer cells while sparing healthy cells” says Pasche.

Zimmerman says, “It is exciting to identify an effect targeting only tumor cells with limited side-effects for patients. As a graduate student, it is a thrill to see translational research in action.”

An *in vitro* system replicating patient-treatment conditions, designed and constructed by Ivan

Brezovich, Ph.D., professor and director of radiation physics in the UAB Department of Radiation Oncology, enabled scientists to examine cancer cells in the laboratory that were exposed to tumor-specific modulation frequencies. They discovered that very low levels of radiofrequency electromagnetic fields, which are comparable to the levels administered to patients, significantly inhibited tumor-cell growth.

To determine how such frequencies impede cancer-cell growth, the team collaborated with Devin Absher, Ph.D., and Rick Myers, Ph.D., from Hudson-Alpha Institute for Biotechnology. The scientists observed the anti-proliferative effect is mediated by changes in gene expression and by disrupting dividing cells.

“This is the first experimental evidence that electromagnetic fields can both down-regulate the expression of genes that control cell migration and affect the mitotic spindle,” says Pasche. “Part of the framework that guides cells as they divide and multiply, mitotic spindles are essential to normal tissue growth and to the fast, abnormal growth seen in cancer. Interfering with them only in cancer cells is an exciting prospect.”

“These findings uncover a new alley to control tumor growth and may have broad implications for cancer treatment,” Pasche says. “We hope these findings help develop and refine a new safe, targeted therapy to kill cancer cells without any collateral damage.”

The UAB Health System includes all of the University of Alabama at Birmingham's patient-care activities, including UAB Hospital, the UAB Callahan Eye Hospital and The Kirklin Clinic. UAB is the state of Alabama's largest employer and an internationally renowned research university and academic health center; its professional schools and specialty patient-care programs are consistently ranked among the nation's top 50. UAB Hospital is one of the 10 largest in the United States. Find more information at www.uab.edu and www.uabmedicine.org .