The effects of weak magnetic fields on cancer cells and other aspects of biology

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We are surrounded by a constantly changing magnetic field, be it the Earth's or those emanating from devices, such as cell phones. Carlos Martino, an assistant professor at the University of Nevada, Reno, is interested in understanding how these magnetic-field fluctuations change biochemical reactions inside us.

Martino explains that the subject is controversial. "Our research shows that exposure to different types of magnetic fields affect biological response," he says. "More importantly, the exposure levels are well below the standard levels" approved by the World Health Organization. "This raises the concern of safety issues," he adds. Martino will be presenting some of his work at the Experimental Biology 2012 meeting in San Diego, California on Monday, April 23.

Magnetic fields come in different types. There are static fields, like those around permanent magnets. The Earth's magnetic field is quasi-static, which means it can fluctuate slightly. Then there are radiofrequency magnetic fields, which may change both in intensity and frequency.

Martino's work concerns low-level static magnetic fields, which are one to two orders of magnitude weaker than the Earth's field, as well as weak radiofrequency magnetic fields. Martino gives the example of cell phones, which give off very weak magnetic fields. There is debate whether these magnetic fields cause brain tumors in cell-phone users.

Martino says his work on low-level fields and radiofrequency magnetic fields raises "the question of reassessing the standard limit of exposure because we clearly see effects both in vitro and in vivo in the low level and radiofrequency magnetic field range."

But it's not all doom and gloom. In fact, by understanding how weak magnetic fields affect cancer cell processes and tumor growth, Martino sees the potential for a therapy based on weak radiofrequency fields.

He explains his group has recently shown that the reduction of the Earth's magnetic field inhibits growth rates of cancerous lung fibrosarcoma cells, colorectal cancer cells and primary endothelial cells. He adds that low-level fields may modulate the production of reactive oxygen molecules, known to affect cellular proliferation and survival. Interestingly, Martino says pancreatic cancer cells show an increase in growth rate in the same low magnetic fields, indicating different cell types react differently to changes in magnetic fields.

Martino has extended his work beyond cell cultures to animal models. For instance, his group has shown that weak radiofrequency magnetic fields inhibit tumor growth in animal models. But in all of his work, Martino says, his group is aiming to get to the bottom of the molecular mechanisms that cause different cells to react in various ways to fluctuations in static and alternating magnetic fields.

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