Keep That Phone Out of Your Trouser Pocket!

Once Again, Australia's Aitken Sees DNA Damage

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It's the strongest warning yet. John Aitken, a well-known fertility researcher, is advising men who want to have children not to keep active mobile phones below their waists. This issue, he says, "deserves our immediate attention."

Aitken's research group at the University of Newcastle in Australia has found that human sperm exposed to mobile phone radiation (1.8 GHz) for 16 hours had reduced vitality and motility, two key indices of fertility. Notably, he has also confirmed his own previous study, published in 2005, which showed that RF radiation could lead to DNA damage. In that earlier experiment, he had exposed mice to 900 MHz signals and then looked at the animals' sperm, in contrast to the new study in which he exposed semen collected from human volunteers.

The new data show striking dose responses for all three effects over a wide range of SARs —above 0.4 W/Kg and up to 27.5 W/Kg. The changes in motility and vitality became statistically significant at 1 W/Kg and the DNA damage at 2.8 W/Kg. In all cases, the statistical reliability of the effects became much more significant with higher SARs. These new results appear in a paper published on July 31 in *PLoS ONE,* a Web-based, peer-reviewed journal. All Public Library of Science (PLoS) journals offer free access to all.

"After 16 hours exposure, there was clear evidence of DNA damage," Aitken said at a fertility conference in Brisbane last fall when he first presented these findings. Aitken is the director of the Australian Research Council's Center of Excellence in Biotechnology and Development.

"Several independent lines of evidence suggest that RF-EMR has the potential to influence semen quality and could be an important contributor to DNA damage in the male germ line," Aitken told *Microwave News.* He said that he would like to see more studies done, especially ones with the statistical power to determine whether RF can indeed affect male fertility.

In an interview published last month, Martine Hours, the chief science advisor to the French RF research program, also called for more fertility studies.

Importantly, Aitken also demonstrates a "potential causative mechanism" as to how RF radiation can lead to DNA damage. He acknowledges that cell phone signals do not have enough energy to directly break chemical bonds, but, he goes on, "[T]his form of radiation may have other effects on larger scale systems such as cells and organelles, which stem from the perturbation of charged molecules and the disruption of electron flow." Specifically he believes that the RF can cause leakage of electrons from the mitochondria and produce reactive oxygen species (ROS), which in turn can attack DNA. This process, he states, is unrelated to thermal stress.

Over a decade ago in a follow-up to their landmark 1995 study which showed that RF radiation can lead to DNA breaks in the brains of exposed rats, Henry Lai and N.P. Singh showed that the DNA breaks were caused by free radicals. (For more on EMFs and DNA damage, see the recent review by Lai, Singh and Jerry Phillips of the University of Colorado in Colorado Springs.)

Aitken found an analogous dose-response relationship for the production of free radicals with increasing SAR —a highly significant one— to the ones for motility, vitality and DNA damage. "[T]he profiles of all the observed effects with respect to SAR were intriguingly similar, suggesting a common underlying mechanism," Aitken writes.

Another of Aitken's results may also be quite meaningful: Only a subset of the sperm cells was vulnerable to RF-induced oxidative stress. "[A]ll of the responses examined showed an extremely rapid change at low SAR exposures that then reached a plateau at a point where around 30% of the sperm population was affected," Aitken reports, but he is quick to add, "[T]his does not mean that a majority of spermatozoa would not, ultimately, be affected by RF-EMR *in vivo*." It might well depend on the duration of the exposure, he says.

Consistent with the Cleveland Clinic

These new results from Australia are consistent with those of Ashok Agarwal and coworkers at the Cleveland Clinic in Ohio. In a paper published last year in *Fertility and Sterility,* Agarwal also reported decreases in sperm motility and viability and increases in ROS in human semen. He concluded, "[K]eeping [a] cell phone in a trouser pocket in talk mode may negatively affect spermatozoa and impair male fertility." Yet, in a subsequent interview with *Newsweek,* when he was asked where he kept his phone, Agarwal replied: "In my

pants pocket." Because, he explained, he does not use a hands-free set (the phone is on standby, not talk mode, there, resulting in less exposure). And because "I already have two children."

Agarwal had previously observed an association between semen quality and cell phone use among men who had visited an infertility clinic. "Semen analysis … showed a decrease in sperm count, motility, viability, and normal morphology with the increase in daily use of cell phone," he reported in that earlier paper, also published in *Fertility and Sterility.* (For a piece on U.S. press coverage of some of Agarwal's early RF-fertility work, see our posts of October 26 and October 27, 2006.)

In the last few years, a second U.S. group (in Wisconsin) as well as others in Hungary, Poland and Turkey —that makes five countries in all— have all shown detrimental effects of cell-phone use or cell-phone radiation on sperm.

In his 2005 paper on the effects of RF radiation on mice, Aitken suggested that one possible implication of his findings is that the EMF link to childhood leukemia seen in residential epidemiological studies may in fact be due to their fathers' radiation exposure. He picks up this theme in his new *PLoS ONE* paper:

> "[T]he fact that sperm DNA is damaged by this form of radiation has additional implications for the health and wellbeing of children born to fathers who have experienced high levels of occupational or environmental exposure to RF-EMR around the time of conception."

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