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Cell Phones: Hazardous to Your Health?

By Raymond Barglow, Special to the Planet (1)

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San Francisco's Commission on the Environment has announced that it will consider a set of recommendations to protect the public from cell phone radiation. These recommendations, which have the tentative support of Mayor Gavin Newsom, include:

- Telecommunications companies will be required to label cell phone packages with the level of radiation the phones emit.
- Local schools will be requested to educate students and their families about cell phone radiation, and use of the phones will be restricted in elementary schools.
- The city will petition federal and state government to review and revise current cell phone safety standards.

Are the dangers of using cell phones sufficient to warrant these recommendations?

Those who advocate stricter oversight remind us of the historical record. In the 1950s, radiation in its many forms, ranging from X-rays to nuclear energy, seemed like a kind of benevolent magic. It could make the face of a watch glow in the dark, measure foot size in your local shoe store, diagnose a fetus in the womb, and fight cancer. Nuclear fission could even drive a new generation of power plants, making electricity "too cheap to meter."



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and industry promise long-time benefits for us all

Union Carbide advertisement, May 1953

There were always a few voices asking questions about the safety of low-level radiation, including the nuclear kind. But these challenges gained little traction with the public or in government circles, partly because the scientific community vouched for the harmlessness of the "peaceful atom."

As the injuries due to radiation piled up, however, reality could no longer be denied. Over the next half century, the concerns began to be listened to, and today the dangers of low-level radiation are widely admitted and better regulated by government.

Those who question the safety of wireless technologies believe that the same pattern of warning and belated response by the authorities is occurring again. The constellation of forces is a familiar one: once again, federal agencies tell us that cell phone radiation is harmless. Once again, many of those working for these agencies and issuing the reassurances have ties to the telecommunications industry that it is their responsibility to regulate. And once again, grassroots activists, supported by a few scientists and engineers, call the government-approved levels of radiation dangerously and unconscionably high.

Indome empirical studies have been published over the past several years in scientific journals that find a correlation between cell phone use and human illness, including cancer. There is also laboratory research purporting to show that this radiation can have biological effects, including the breaking of DNA strands and formation of free radicals.(2)

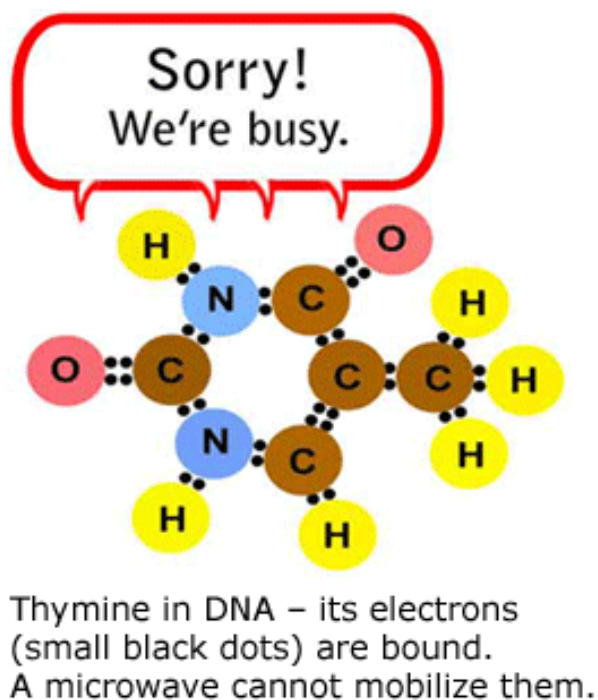
In the Bay Area, this new protest movement finds many sympathizers, who recommend that the "precautionary principle" be applied to cell phones.(3) But the mainstream view among researchers in the physical and biological sciences is that radiation at cell phone frequencies is far too weak (by a factor of at least a million) to wreak any biological damage. They argue first of all that the heating effects of the radiation are insignificant (although this is disputed by some of those who warn about this technology). They also point out an important difference between nuclear radiation and cell-phone radiation: Cell phones emit and receive microwaves that are non-ionizing -- that lack the energy to lift an electron out of its orbit in an atom, thereby leading to potential biological damage. (4)

We know, however, that heating and ionization are not the only consequences that a microwave can have. After all, electrical currents are generated in a cell phone receiver that intercepts microwave radiation. If radiation of this kind can affect an

electronic component in a cell phone, might it not also affect a biological process in a human body?

The prevalent view from the physical and life sciences is that it cannot. A cell phone works only because of the extraordinary properties of its internal metallic conductor. Atoms in a metal like copper hold their outermost electrons only loosely, and something as weak as a microwave can mobilize and align them in very large numbers to resonate and create a current. Much like a tuning fork in the presence of a sound wave, a cell phone conductor responds to microwave radiation whose frequency of oscillation matches that of the conductor. In this way a tiny motion of electrons can be made to resonate and amplify into a sustained current.

The organic molecules of life, on the other hand, hold on tightly to their electrons -- so much so that it takes a powerful energy blast, far stronger than microwave radiation, to detach one of them. The electrons in a DNA molecule such as thymine, for instance, knit together and are firmly attached to thymine's atoms.



The electrons in a copper conductor are, one might say, like enthusiastic volunteers who can be readily recruited to work together in a grassroots political campaign. Thymine's electrons, on the other hand, are apolitical, so to speak, and fully engaged with business as usual -- the work they're doing in the body. They're not

available to be mobilized to break a DNA strand, speed up or retard a chemical reaction, or interfere with a normal biological function.

But how can this reassuring conclusion be reconciled with empirical studies indicating that the radiation is dangerous? Scientists who believe that cell phones are safe don't find these studies credible. After all, many mistaken convictions appear to be supported by "empirical evidence"; a search on the Internet reveals dozens of "scientific" studies that "prove" that global warming, if it exists at all, does not result from human activity.

The UC Berkeley physicists and biologists I talked with in preparing to write this article are skeptical about the statistical "evidence" showing cell phone use to be dangerous because they can think of no scientifically plausible chain of events whereby radiation from a cell phone might disrupt a biological process.

Of course the absence of a plausible causal link today doesn't mean that one won't be found tomorrow. Sometimes in the history of science, a correlation is observed before the underlying causal mechanism that explains it is discovered. Even today, we're not sure we understand exactly how smoking leads to a wide variety of illnesses, but epidemiological studies establish beyond a doubt that it does.

The debate about cell phone safety will continue in Berkeley, San Francisco, and communities across the country. Should these communities be empowered to approve or change safety standards? Can a lay public be expected to disentangle the very different kinds of radiation and assess the hazards of each? There is a dilemma here at the heart of political theory: Authentic democracy requires that citizens be well-informed. But in a technologically complex society, how can ordinary citizens (or their political representatives, who also lack specialized knowledge) thoughtfully evaluate and oversee technical innovation? Democratic decision-making will work well only if the American public becomes more knowledgeable about scientific matters than it is today. (5)

Raymond Barglow studied physics at Cal Tech and is the founder of Berkeley Tutors Network.

(1) To prepare this article, those who patiently helped me sort out and wrestle with the issues include Michael Barglow and Laurie Baumgarten of the Berkeley LeConte Neighborhood Association; Lloyd Morgan, an electronic engineer in Berkeley; Louis Slesin, editor of Microwave News; Jeff Moffitt, biophysics graduate student, UC

Berkeley; Richard Muller, physicist, UC Berkeley; Robert Cahn, physicist, Lawrence Berkeley Laboratory; Michael Vollmer, physicist, Brandenburg Germany; and Michael Goldhaber, physicist and technology theorist.

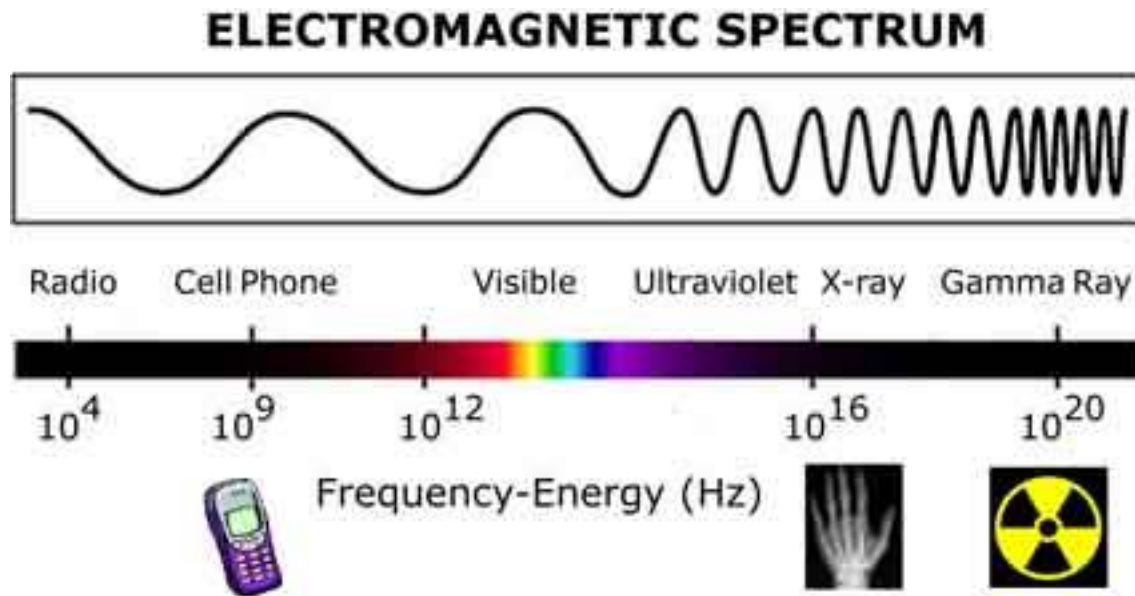
(2) A US Senate hearing, held In September 2009 on Health Effects of Cell Phone Use, reviewed some of the current empirical evidence: [Senate Hearing](#).

Currently, the "Interphone Study," which includes research in 13 nations, is investigating links between brain tumors and cell phone use. Lloyd Morgan criticizes this research in his blog "Powerwatch."

A difficulty that such research faces, according to some of those who warn about wireless technologies, is that cell phone-induced cancer may have a long latency period, taking as long as thirty years to produce symptoms.

(3) In 2006, a group of Berkeley residents requested that the city not permit telecommunication companies to place new cell phone antennas in their neighborhood. During the next two years, the Zoning & Adjustments Board and the City Council heard testimony on this request and on the installation of antennas in other neighborhoods as well. This dispute was examined in a number of articles in the Berkeley Daily Planet, including: "Settlement Ends Cell Antenna Suit."

(4) The spectrum of electromagnetic radiation ranges from radio at the low-energy end to gamma rays at the high-energy end. Cell phone radiation (frequency of about 10^9 hertz) has a little more energy than radio and is much weaker than any ionizing radiation (frequencies above 10^{15} hertz)



(5) In Berkeley, the relevance of high school science education to informed citizenship in a democratic society has been emphasized by community members who oppose a current proposal to drop some science labs at Berkeley High School. A letter distributed among BHS parents attests to the value of scientific literacy:

"The issues facing our students (global warming, the destruction of the ozone layer, urban pollution, health issues such as diabetes, cancer, etc.) require that our students be well-grounded in the underlying science behind these issues. For many of our students, high school will be the last time they will take a biology or physics course. We cannot afford to shortchange them in these subjects."