Microwaves: Hints of low-dose hazards

Rats receiving lifelong low-dose irradiation with microwaves developed a higher rate of cancer and endocrine-system abnormalities than did unexposed animals maintained under identical "pathogen free" conditions, according to a new study. Don Justesen, president of the Bioelectromagnetics Society, says the study "is probably the most rigorously prosecuted and carefully done in the annals of microwave research." Though portions of the study were unveiled at an annual meeting of the society last month, one of the first written accounts of the research (including some data that have not yet been formally presented) appears in an issue of MICROWAVE NEWS published Aug. 17.

In the study, headed by Arthur W. Guy, director of the Bioelectromagnetics Research Laboratory at the University of Washington School of Medicine in Seattle, 100 rats were exposed to pulsed 2,450 megahertz (MHz) radiation for 21 hours daily. The Air Force, which funded the study, was looking for potential biological effects relating to radar frequencies, explains associate laboratory director C.K. Chou. The study attempts to simulate the effects of these wavelengths on military personnel or civilians exposed to radar (using rats, the wavelength must be shorter). The power density chosen attempts to approximate a rate of energy absorption that is equal to or lower than the current voluntary U.S. safety standard for humans of 0.4 watts per kilogram of body tissue.

After 3 months, 10 animals each from the exposed and nonexposed groups were sacrificed. Among irradiated animals "we found a significant increase — almost a doubling—in the T cells and B cells," Chou told SCIENCE NEWS. "That's an immune response, but nobody can tell whether this is good for the animals or bad." A similar increase was not evident in the roughly 10 animals in each group that survived to the study's completion 12 months later. However, the weight of adrenal glands was roughly twice as high among irradiated animals that survived. Though adrenal increases can be a compensatory response of bodies under stress, Chou notes that levels of corticosterone in the animals' blood — usually an index of stress — were similar for both groups.

Most perplexing is the fourfold higher rate of cancer—16 versus 4—experienced by the irradiated rats. Though even the 16 cancers are fewer than would normally have been expected — based on previous studies — for this strain of rats, Justesen notes that the numbers reported by Guy's group are nonetheless "statistically highly reliable." There is "about one chance in 100," he says, that this could be a chance finding.

Washington State health department epidemiologist Samuel Milham is among those who see the effects reported here as suggesting that microwaves may act upon the body as a source of nonspecific stress. Specifically, he described as "*very* suspicious" the fact that the irradiated cohort developed so many endocrine-system effects: increased adrenal mass, seven malignant endocrine-system tumors (versus one in the control group), and six benign — though functionally hazardous — tumors of the adrenal medulla (versus none in the controls).

The Washington team cautions that the study must be replicated before microwaves can be indicted, particularly as a tumor hazard. According to Chou, a good tumor study should involve perhaps 100-fold more animals. —*J. Raloff*

Space research: Don't forget the science

It is a relatively small item in the National Aeronautics and Space Administration's budget each year — perhaps $100 million out of billions, usually little more than 1 percent of the total. And yet, notes a panel of scientists in a report to the agency, it is "at the very core of NASA's abilities to reach its goals." But the Research and Analysis (R&A) Program, which handles the study of data about the planets, stars and space itself as well as the development of new instruments and techniques, is viewed by many researchers as facing a constantly uphill struggle.

It does not have the dramatic visibility, sometimes dubbed "sex appeal," of the spacecraft programs themselves. It is invariably included in the recommendations of such bodies as the NASA-chartered Solar System Exploration Committee or the National Academy of Sciences' Committee on Planetary and Lunar Exploration. But in recent years the primary focus has been on the need for new missions, which must often be started half a decade before their fulfillment. Now NASA's Space and Earth Science Advisory Committee (SESAC) has sent the agency a report centered squarely on the matter of R&A — which, says the group, must be given "a priority in funding and attention commensurate with that of flight programs."

"It cannot be emphasized too strongly," says the report, "that the quality of NASA's scientific program and the return that the country receives from its investment in space missions, directly depends upon the effectiveness, the health and the vitality of the [R&A] Program." While endeavors such as the Viking and Voyager trips to Mars, Jupiter and Saturn are the "often dazzlingly visible aspects" of the U.S. pursuit of space exploration, the report notes, "the NASA flight missions do not stand alone."

The "most pressing problem," perhaps to no one's surprise, is "inadequate funding." But the numbers being discussed by SESAC for this "core of NASA's abilities to reach its goals" are relatively small. Certain areas, in fact, such as some programs in the earth sciences (upper atmosphere research is a cited example), actually appear to be "adequately funded." Other fields, however, such as solar system studies and climate research, could show "substantial beneficial consequences" from "relatively modest changes in funding." A $10 million boost for R&A in solar system exploration, for example, says the report, would permit not only upgrading of aged laboratory instruments and a return to "earlier levels of core science support," but also enhanced studies (both observations and data reduction) of Comet Halley, increased U.S. participation in anticipated foreign missions, continued analysis of the mountain of existing and expected Mars data, and wider study of the Voyager spacecraft's January 1986 flyby of Uranus. Similarly small increases, by SESAC's reckoning, would benefit astrophysics and even aspects of the earth sciences, such as the study of "land-biosphere-atmosphere interactions."

Part of the problem, says the report, is that in many such areas "R&A buying power has decreased 50 percent compared to 1979." And the need is not only to fund more scientists' time. "It has been recognized in many national forums," the report points out, "that laboratory and experimental equipment acquired by researchers throughout the scientific community in the United States during the early 1960s and '70s has fallen into disrepair, become all but impossible to maintain, and been made obsolete by dramatic technological advances ... We are now training the next generation of scientists and engineers with antiquated equipment and expecting critical experiments to be carried out with inadequate instrumentation. Many European and Japanese laboratories are equipped with instrumentation far superior to our own." Such equipment often exists in the United States, notes SESAC member Laurel Wilkening of the University of Arizona in Tucson, but it is usually in other arenas such as industry or the military.

In the last three years, admits one high NASA official, budget-by-budget restorations of some R&A funds have depended on the scientific community lobbying Congress directly. The SESAC report, he says, is NASA's advisers telling the agency to address a problem central to its own mission. —*J. Eberhart*