Radiation Damages Chernobyl Children

Survivors of the fiery meltdown of Reactor 4 in Chernobyl a decade ago won't welcome the news that radiation has altered the genetic legacy they have passed on to their children. But that is precisely what a team of Russian and British scientists has concluded in a report that began to draw critical fire from other researchers even before it appeared in the April 25 NATURE.

The study, published on the eve of the 10th anniversary of the nuclear disaster in the former Soviet Union, suggests that parents exposed to radiation acquired measurable mutations in their germ cells. Those cells—sperm and eggs—contain the genetic building blocks of future generations.

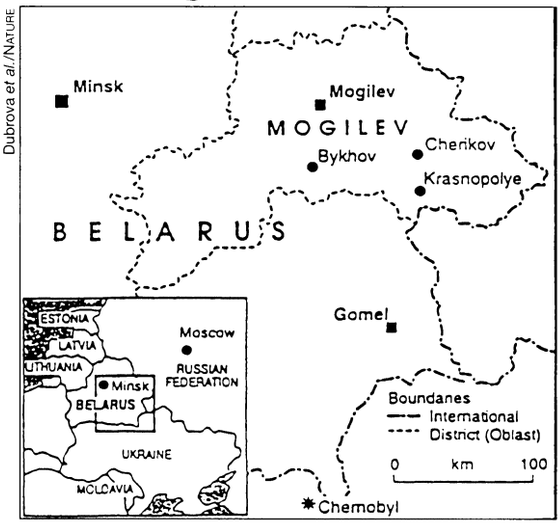
Before Chernobyl exposed some 5 million people to radioactive fallout, survivors of the U.S. bombings of the Japanese cities of Hiroshima and Nagasaki formed the only large populations exposed to significant amounts of radiation. After World War II, the United States and Japan set up a joint research effort in Hiroshima to study those populations. Forty years later, no scientist from either nation has produced evidence of genetic problems in survivors' children.

The Hiroshima findings come largely from studies of birth defects and major chromosomal damage, however. Researchers have only recently begun using the techniques of molecular biology to examine genes.

Now, Yuri E. Dubrova of the University of Leicester in England and his colleagues claim they have found "the first scientific evidence that germline mutation rates in humans can be increased by ionizing radiation."

Other researchers, such as James Neel of the University of Michigan in Ann Arbor, a 40-year veteran of the Hiroshima research, are not so sure. "I am very doubtful that the findings of these investigations are due to the fallout of the Chernobyl disaster," Neel says.

Dubrova's team compared specific gene segments isolated from the blood of people in 79 families that live in heavily contaminated Belarus with those from members of 105 unexposed families in the United Kingdom. All children in both groups were born 8 years after the meltdown.



Contaminated region north of Chernobyl.

The researchers studied gene segments known as minisatellite loci, repeating patterns of roughly 5 to 45 bases, the units that make up DNA. No one knows the genetic purpose, if any, of minisatellites, but their variation from person to person enables scientists to use them as the basis of so-called genetic fingerprinting.

Because a child's DNA represents a combination of germline DNA from both parents, any sequence in the child that does not appear in either parent must result from a germline mutation. Dubrova's team therefore looked for minisatellite sequences in children's DNA that did not appear in either parent's DNA.

They found twice the number of mutations in children of exposed Belarus parents as in U.K. children. "We are 99 percent sure these are real germline mutations and they have been passed from parent to child," Dubrova says.

Neel objects that the "doses of radiation given in their paper are very low, so their report implies a genetic sensitivity far beyond that observed in experiments with fruit flies and mice and our own observations in Japan." He adds that controls should have come from Belarus, not the United Kingdom. Dubrova counters that finding uncontaminated people in Belarus would be next to impossible.

Radiation effects also show up in wildlife in the region, according to a separate report in NATURE. Biologist Robert J. Baker of Texas Tech University in Lubbock says he found mutation rates in two species of mice that were "probably thousands of times greater" than normal.

More evidence of a lumpy universe

Bunched into giant walls or packed along spidery filaments, galaxies a few hundred million light-years from Earth display a decidedly lumpy pattern. Several models suggest that this cosmic architecture formed relatively recently. They predict that as astronomers map the distribution of galaxies deeper in space—equivalent to looking further back in time—they should see the lumpiness smooth out rapidly.

Now, a new study suggests that lumpiness in the universe may have arisen earlier and persisted longer than many theorists have asserted.

To study the distribution of distant galaxies, Judith G. Cohen and her colleagues at the California Institute of Technology in Pasadena used the world's largest optical telescope, the W.M. Keck atop Hawaii's Mauna Kea. The team measured the recession velocities, or redshifts, of 106 faint galaxies in a small patch of sky. Because the universe is expanding, more distant galaxies recede from Earth faster than nearby ones, and their light is correspondingly shifted to longer, or redder, wavelengths.

Some of the galaxies in this infrared survey lie halfway to the edge of the visible universe—several billion light-years from Earth. The redshifts reveal that 64 of the 106 galaxies aren't spread out evenly, but cluster together in five groupings, notes Cohen.

No similar survey has "found as much strong redshift clustering as is presented here," she and her colleagues, David W. Hogg, Michael A. Pahre, and Roger Blandford, will report in the May 1 ASTROPHYSICAL JOURNAL LETTERS.

Richard E. Griffiths of Johns Hopkins University in Baltimore cautions that the number of galaxies in any one grouping is small. Nonetheless, he adds, "there may be a lot more clumping than we otherwise thought at large distances. Models of structure formation are going to have to take [this] into account."

To determine whether her team has truly seen clustering, Cohen plans to examine whether galaxies in adjacent patches of sky congregate in a similar fashion. This larger study may also reveal whether the galaxies have bunched into isolated groups or organized into extended walls—a more complex pattern. Theorists who favor recent formation of large-scale structure will have an even harder time accounting for the early development of walls. —*R. Cowen*

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