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RESEARCH NEWS

APRIL 25, 1996

Chernobyl's Grim Genetic Legacy

Sir Alec Jeffreys shared some bad news on the 10th anniversary of the worst nuclear power accident in history. The British geneticist and his Russian colleague, Yuri Dubrova, reported that mutation rates are unusually high among the children of families exposed to radioactive fallout from the Chernobyl reactor meltdown in Ukraine.

Jeffreys is one of the Institute's 22 international research scholars in the United Kingdom. The collaborative study was the subject of a cover story in *Nature* on April 25, 1996, the week that marked the anniversary of the Chernobyl disaster.

"International research scholar Alec Jeffeys believes that radiation leaked from Chernobyl more than a decade ago may only now be manifesting its diastrous legacy."

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During the past decade, physicians and government officials in eastern Europe have grappled with the deaths of thousands from radiation-related illness such as thyroid cancer. They haven't known how the fallout might affect future generations.

Attracting worldwide attention, Jeffreys' results suggest the impact may last longer than expected. The study provides the first direct evidence that children can inherit radiation-triggered germline mutations from their parents. The findings are particularly troublesome because the study population lived in Belarus, more than 100 miles north of the doomed reactor. The families in the study probably received far lower radiation exposure than the 116,000 people evacuated from within 15 miles of the nuclear power plant.

"Given the relatively low dose rates in the Belarus population sample we collected, we did not expect to see any increase in mutations," Jeffreys said. The results indicate that the genetic consequences of such incidents are greater and longer-lived than previous studies suggested. Jeffreys' team started its Chernobyl study in 1994 in collaboration with Russian researchers, including lead author Yuri Dubrova of the Institute of General Genetics in Moscow. "The idea was to collect blood from contemporary births to get an overall view of parental radiation during the previous eight years," Jeffreys said.

Colleagues at the Institute of Radiation Medicine in Mogilev, Belarus, collected blood samples from local maternity hospitals. The rural Mogilev district was hit fairly hard by Chernobyl's radioactive fallout, including iodine-131. In the years following the accident, most Mogilev residents have eaten food grown in soil contaminated with radioactive cesium-137. Their exposure to radiation has been low but chronic.

The samples were brought to Jeffreys' lab in England, where they were analyzed to produce DNA fingerprints that establish identity and paternity. Studying each family's blood samples, the researchers used five different systems for monitoring mutations. They asked two questions: Does the mutation rate in Mogilev exceed natural levels? And, if so, are these mutations due to radiation exposure?

To answer those questions, the researchers compared the Mogilev blood samples with those of 105 non-irradiated families from England (the control group). They found that the frequency of mutation was twice as high in families from Mogilev than in families from England. Among the Mogilev families, children with the higher mutation rates lived in areas where the soil is most contaminated with radioactive cesium-137, another indication that radiation exposure might be causing the additional mutations.

For now, the most Jeffreys and his colleagues can conclude is that the mutations seen in the human study will likely be passed along to future generations because they are germline in origin. Larger questions loom. Both scientists and the public wonder whether the high mutation rates will translate into greater health problems for future generations. That's a question the researchers cannot answer at this time.

One problem is that Jeffreys and colleagues cannot draw upon past studies with similar findings. There aren't any. Despite decades of research, there is no evidence for increased mutation rates in the genome of residents of Hiroshima and Nagasaki since the atomic bombs were dropped on those

cities in 1945. It is very difficult even to compare the Japanese and Chernobyl results because the radiation exposure of the two populations is so different. What's more, animal studies are lacking. Few researchers have conducted large-scale studies exposing mice to chronic, low radiation like the kind caused by Chernobyl, Jeffreys said.

"Mutations [in the genes] that we studied are most unlikely to have any health implications for these children or their descendants," Jeffreys said. "It is impossible to say whether other classes of mutations of greater potential biological significance also will show a corresponding increase in mutation frequency." However, Jeffreys said it is very unlikely the mutation rate is a statistical fluke. He and Dubrova continue their investigations.