Love Canal: False Alarm Caused by Botched Study

In the opinion of many experts, the chromosome damage study ordered by the EPA has close to zero scientific significance

The much-publicized study of chromosome damage among residents of Love Canal has been discredited. The most recent attack was by a panel convened by the Environmental Protection Agency (EPA) on 27 May, which concluded that the study has virtually no value and cannot be salvaged. The report was meant to be legal, not scientific, evidence for the Justice Department in its suit against Hooker Chemical. Tragically, the EPA has ended up by needlessly terrifying the Love Canal residents.

Love Canal has for several years been "a neighborhood of fear," says New York Governor Carey. Residents have been increasingly alarmed by reports that the toxic wastes buried in the area may be causing cancer, miscarriages, birth defects, and seizures.

The latest episode in the saga of Love Canal began on 17 May. On that day the EPA released a report saying that Love Canal residents may have damaged chromosomes and might therefore be at an increased risk of developing cancer or having children with birth defects.

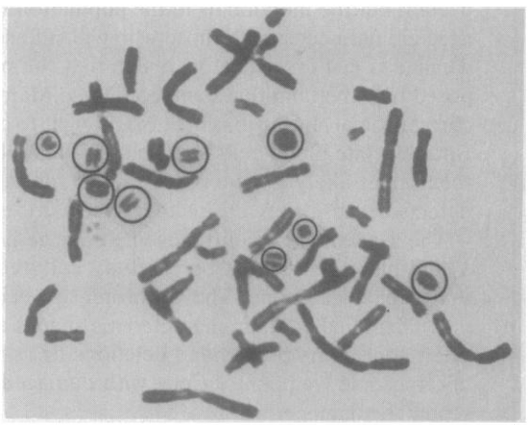
The residents reacted emotionally to the EPA report, with nearly hysterical demands that they be evacuated from the area. "It [the EPA report] was one more frightening, scary thing and we couldn't take it any more," says Lois Gibbs, head of the Love Canal Homeowners Association. On 21 May, President Carter declared a state of emergency at Love Canal, clearing the way for the relocation of about 2500 residents, at a cost to the federal government of $3 million to $5 million.

Barbara Blum, deputy EPA administrator, announced the relocation at an EPA news conference. But she was careful not to attribute the move to the report on chromosome damage. "This action is being taken in recognition of the cumulative evidence of exposure to toxic wastes . . . and of mounting evidence of resulting health effects," she said. In fact, the chromosome study had just been severely criticized by a panel of experts who reviewed it for the Department of Health and Human Services (HHS). Serious questions were raised about whether the study shows anything at all about the residents' chromosomes and why the EPA conducted such a study in the first place.

The EPA has reason to be interested in Love Canal. It is suing the Hooker Chemical and Plastics Corporation (now owned by Occidental Petroleum) for $124.5 million, charging it with dumping toxic chemical wastes at Love Canal and at three other sites in the Niagara Falls area. From 1947 to 1952 Hooker dumped 21,800 tons of chemicals at Love Canal, but it contends that it disposed of these wastes in full accordance with environmental regulations at that time. In 1953 Hooker sold the Love Canal dump site to the Niagara School Board for $1 with a deed disclaiming responsibility for any injuries that might result from the buried wastes. In addition to building a school on the dump site, the school board sold the remaining land to developers, who built houses there.

Over the past decade, toxic chemicals have been leaching from the land into the homes and schools on the site. Last year, the EPA said that four suspected carcinogens were found in air samples near the contaminated area. Residents have complained that they are ill and that they have unusually high frequencies of cancer, miscarriages, and birth defects. These effects have been difficult to document, but many scientists believe it is certainly time for well-designed medical and epidemiological studies to be conducted at Love Canal.

The EPA study, however, was not well designed. It was not even meant to be scientific, according to Stephen Gage, assistant administrator for research and development at EPA. "This [the study] was a small fishing expedition. The Justice Department asked us to undertake it in connection with our suit against Hooker," he says.



Chromosome damage. Ring chromosomes and chromosomal fragments, which are two forms of damage, are circled. [Source: L. Atkins, Massachusetts General Hospital]

The difficulties with the EPA study were first brought to light when HHS asked a panel of eight scientists, three of whom are cytogeneticists, to review it. The scientists had seen the written report and had serious reservations about it. But they felt that they needed to see the data before coming to any final conclusions.

The data were in the hands of Dante Picciano, who conducted the study under an EPA contract and who works for the Biogenics Corporation in Houston. Charles Carter, scientific director of the National Institute of Environmental Health Sciences and chairman of the HHS panel, spoke to the EPA about seeing the data and was given the impression that if the panel members went to Houston, the data would be available and they could speak to Picciano.

On the night of 19 May, the HHS panel flew to Houston. When they arrived, however, they learned that Picciano

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would neither speak to them nor release his data unless he could place a person of his choosing on the panel. Carter negotiated well into the night with HHS officials and with the Biogenics Corporation over whether Picciano's demand should be met and, if so, who would be an acceptable addition to the panel. Finally, the Biogenics Corporation insisted that Jack Killian, a controversial figure in the field of cytogenetics, be a member of the HHS panel.

At this point, says Carter, negotiations ceased and the panel members went home. Killian was completely unacceptable to the panel because he had been Picciano's collaborator in a previous highly disputed study of chromosome damage among workers at Dow Chemical Company. The HHS panel, Carter reports, questioned whether Killian might also have some association with Biogenics. Picciano says he sees nothing wrong with insisting that Killian be a member of the HHS panel. "I think it is a normal procedure in a scientific review to appoint someone or object to someone on the team," he explains.

Unable to see Picciano's data, the HHS panel was forced to rely on his written report. On 21 May, HHS released the panel's assessment of the report and its conclusion that the study "provides inadequate basis for any scientific or medical inferences from the data (even of a tentative or preliminary nature) concerning exposure to mutagenic substances because of residence in the Love Canal area."

The three cytogeneticists on the HHS panel were Sheldon Wolff of the University of California at San Francisco, Arthur Bloom of Columbia University, and Michael Bender of Brookhaven National Laboratory. All agree that the most glaring deficiency of the study was its lack of simultaneous controls and that, for this reason alone, the results are meaningless.

Everyone has some amount of chromosome damage, which may be caused by viral infections, medical or dental x-rays, or exposure to chemicals, to sunlight, or to certain medications. It is thus extremely important that the cells of a suspect population be compared to those of a control population to see if the suspect population has, on the average, excessive chromosomal aberrations. The controls should be closely matched to the exposed subjects in terms of age, sex, medical history, and geographic area because all of these factors can affect the numbers of aberrations. Since cells are grown in the laboratory before they are examined for chromosome damage and laboratory conditions can affect the number of chromosomal aberrations, the controls and test cells should be cultured at the same time. In addition, Bloom stresses, the person assessing the aberrations should not know which cells are from the exposed population and which from the controls. "This is a very subjective science," he says.

Rather than following this prescription for a well-controlled study, Picciano compared the chromosomes of the Love Canal population to those of a population that he had studied earlier and that, he

Chromosome Damage: What It Is, What It Means

Chromosome damage is an important test of whether people have been exposed to toxic chemicals. But the test is hard to interpret. Some damage occurs naturally because of such things as colds, flu, x-rays, and sunlight, and damage also increases as a person ages. People who have come into contact with a toxic substance, however, may have more damage than a comparable group that has not been so exposed.

Excess damage in a population may have some meaning but on an individual basis it does not. On the average, a population with damaged chromosomes may have more cancer and more birth defects than otherwise expected, but the individuals in the population whose chromosomes are damaged are not necessarily those who will suffer these ill effects. Chromosome damage is just an indicator, a sign that the population may have been exposed to something that damages DNA. Many of the substances that cause chromosomal aberrations are also thought to cause cancer and birth defects. But the white blood cells sampled for a test of chromosome damage are not themselves likely to give rise to cancer, and they cannot contribute to birth defects because they are neither sperm nor egg cells.

The assessment of chromosome damage is as much an art as a science. White blood cells must be carefully cultured, then stained and examined under the microscope. The 46 chromosomes in a human cell can be individually identified by their characteristic shapes and sizes. If there is damage, it often appears as breaks and deletions or as rings, which are formed from chromosome fragments. Cells with damaged chromosomes usually die or repair the damage.

Although the chromosomes are the carriers of genes, almost never can specific chromosomal aberrations be associated with specific birth defects or cancer. One exception is Down's syndrome, in which individuals inherit an extra chromosome 21 and this extra chromosome shows up in all their cells. But most genetic defects and most DNA damage that may lead to cancer involve submicroscopic changes in DNA and quite often do not lead to physical changes in the chromosomes. There is only indirect evidence associating chromosome damage with birth defects and cancer.

Perhaps the best evidence correlating damaged chromosomes with an increased incidence of cancer comes from the survivors of Hiroshima and Nagasaki. They had a significant amount of chromosome damage, which was directly related to the dose of radiation they had recieved. Moreover, the more radiation they were exposed to, the greater their incidence of cancer. But even in that population, those with the greatest amount of chromosome damage were not necessarily those who got cancer.

Among the Hiroshima and Nagasaki survivors, there was no statistically significant increase in birth defects and miscarriages. Ionizing radiation is known to cause birth defects and miscarriages, but the normal rate of these incidents is so high that it is very hard to show a significant increase, especially in a small population, according to Jean French of the Center for Disease Control. Nearly 11 percent of all children born have genetic defects, and as many as 50 percent of all pregnancies are estimated to end in a spontaneous abortion.

"It's a scary thing to tell people they have chromosome breaks," says Arthur Bloom of Columbia University. "But the breaks are by no means a harbinger of cancer or birth defects."—GINA BARI KOLATA

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said, had no known exposure to toxic chemicals. Picciano agrees that simultaneous controls are desirable, as does Beverley Paigen of Roswell Park Memorial Institute. Paigen selected the Love Canal residents whose blood was sampled and helped design the chromosome study. But Picciano and Paigen disagree on why there were no simultaneous controls, although both blame the EPA.

According to Picciano, because the EPA wanted the study done so quickly there was no time to select simultaneous controls. (The study was begun in January and completed in May.) Paigen says that she had already chosen appropriate control subjects before the study began but the EPA ruled them out because it did not want to spend much money. (The study cost $10,000.) Chuck Morgan of EPA says the agency cannot comment on why the study had no simultaneous controls because "this is an enforcement investigation."

Picciano, Paigen, and Gage say that even though the lack of simultaneous controls is a flaw, the study nonetheless does provide evidence that some Love Canal residents may have excessive chromosome damage. The residents did not differ significantly in the types of aberrations observed in the control groups. But, Gage explains, they did have a highly unusual sort of damage, something Picciano calls "supernumerary acentric chromosomes." Picciano claims that 8 of 36 Love Canal residents had this sort of damage and none of the controls did. He estimates, "from my own experience," that such aberrations should normally occur in only 1 out of 100 individuals.

The cytogeneticists on the HHS panel, however, say that the term supernumerary acentric chromosomes is not a standard one and they are not sure what Picciano was seeing. Since he refuses to show them his slides, there is no way for them to know what, if anything, he saw. The cytogeneticists have other criticisms of Picciano's methodology and would also like to see data on how the Love Canal residents were selected for testing.

The mystery of the supernumerary acentric chromosomes has now been solved by an EPA-sponsored panel. Reacting to the severe criticisms of the chromosome study, the EPA asked Roy Albert of New York University to organize a panel to review the study's data. The panel met on 27 May. Sidney Green and Peter Voytek of the EPA sat in on the session. The panel members were provided with photocopies of the photographs of the chromosome preparations so they could look for the supernumerary acentric chromosomes.

But when the EPA panel looked at the data, they saw nothing that could by any stretch of the imagination be called supernumerary acentric chromosomes. Even worse, sources say, the panel found that Picciano himself was inconsistent in what he called supernumerary acentric chromosomes. One time, for example, it was a chromosome 1 that had broken in half. Another time, it was another sort of break. The EPA panel concluded that there was no evidence that the Love Canal residents had excessive chromosome abnormalities and that supernumerary acentric chromosomes exist only in the mind of Picciano.

Considering the irredeemable flaws in the EPA study, a number of cytogeneticists have been asking why Picciano was asked to do it. Gage says that Picciano had done other consulting work for the agency in the past and that he is very experienced in assessing chromosome damage. But Picciano's dispute with Dow Chemical is well known and has caused the HHS panel members, at least, to wonder why a less controversial scientist was not chosen.

Picciano and Killian resigned from Dow Chemical after that company refused to release their study on chromosome damage in Dow workers exposed to benzene. Using the same group of historical controls that was used for the Love Canal study, Picciano and Killian concluded that the benzene workers had excessive chromosomal aberrations. Dow questioned the study on grounds similar to those raised by the HHS panel who reviewed the Love Canal study. The company says it then redid the benzene study with simultaneous controls and found no evidence of chromosomal aberrations in the benzene workers.

Perry Gehring, director of health and environmental sciences for Dow Chemical, is vehement about the scientific problems with Picciano and Killian's benzene study. "If Picciano used the same controls in the Love Canal study as in the benzene study then I assure you there are no controls," he says. Gehring claims that Picciano and Killian selectively removed from their control group cells with unusually large numbers of aberrations. Picciano, told of this charge, laughed and said, "Did I do that? I don't remember doing that."

Gehring says that Dow reevaluated Picciano and Killian's slides of chromosomal aberrations in the benzene workers and also sent the slides to an outside consultant for evaluation. A number of the aberrations allegedly seen by Picciano and Killian could not be substantiated, according to Gehring. Picciano, however, says his only disagreement with Dow was on the level of the workers' exposure to benzene.

AP Photo

Love Canal children seek evacuation.

After leaving Dow, Picciano worked for a time at the Occupational Health and Safety Administration (OSHA). He gave OSHA his study of the Dow benzene workers and, 2 years ago, OSHA submitted the study as evidence at a hearing to reduce the allowable exposure of workers to benzene. The Manufacturing Chemists Association asked James H. Jandel, a hematologist at Harvard Medical School, to take a look at the data. Jandel agreed and requested that his colleague Peter Tishler, a cytogeneticist, comment as well. Neither Jandel nor Tishler thought the study was scientifically adequate. "I was very unimpressed," says Tishler. Among their numerous criticisms were the lack of concurrent controls and the failure to use modern staining techniques, which are also criticisms of the Love Canal study made by the HHS panel. "The sloppy way in which this [the benzene study] was handled is offensive to me," says Jandel. The court decided to stay the request for lower allowable benzene exposure levels.

Picciano, Paigen, and the EPA say the significance of the Love Canal study has been blown out of all proportion. It was only meant to be a pilot study to show whether a larger and more scientific study is warranted. And the preliminary evidence from the Love Canal study convinces them that a larger study is worthwhile.

The critics of the Love Canal study, on the other hand, explain that it is illogical to say that an unscientific study can provide evidence of anything. And they say that the tragedy of the situation is that the Love Canal residents are the ones to suffer.

Phyllis Whitenight, a Love Canal homeowner, was a subject in Picciano's study and was one of those found to have supernumerary acentric chromosomes. Her reaction to the study and its critics is that the government is trying to whitewash some very scary data. Whitenight had breast cancer nearly 5 years ago but the cancer had not spread and she says she was given no chemotherapy or radiation treatments following her mastectomy. Until the chromosome report, she had thought her prognosis was good. "Now the fear comes back," she says.

Gibbs, speaking for the Love Canal Homeowners Association, says Picciano's report "is very frightening to the residents." She believes it indicates that the residents are at risk for cancer, birth defects, and miscarriages. The HHS review of the data, she says, is seen by the residents as "almost an attempt to sabotage the report." The residents think the government is trying to adjust the figures and minimize the risk by criticizing the study. "It scared the hell out of the residents when the government reacted [to Picciano's report] by moving people out," Gibbs remarks.

In the view of several critics, the EPA made an incredible blunder by releasing such a poorly conducted study. Far from aiding its case against Hooker, the agency may have hurt it. "If there's anything to bring joy to the heart of Hooker, it's a discussion in the public press that questions the validity of the EPA data and the interpretation of it," says one federal administrator. The EPA may also have damaged its credibility in the scientific community. "I for one will never believe anything the EPA says or releases again unless it has been peer reviewed," says Ernest Hook, of the New York State Health Department and a member of the HHS panel.

—GINA BARI KOLATA

Love Canal Residents Under Stress

Psychological effects may be greater than physical harm

The government's decision to help relocate 710 families living near Love Canal has done little to dissipate the miasma of fear and anger that envelopes the area. "People are very, very frightened, almost panicked," said Lois Gibbs, president of the Love Canal Homeowners Association, 3 days after the decision, which followed on the heels of an Environmental Protection Agency study that showed chromosome damage in 11 of 36 persons tested.

Panic, said Gibbs, was why the homeowners association kept two EPA officials hostage for several hours. The action, she says, was a "direct result" of the study being released "with nobody to tell us what it meant or what they were going to do about it." If the EPA officials had been let out the front door, "they would have been torn apart."

In the almost 2 years since the families living nearest the old chemical dump site were evacuated, residents of the surrounding area have been living under tremendous stress. So rancorous had the atmosphere become that a couple of weeks before the latest relocation decision, one mental health worker says, "we thought they [the residents] were going to torch the neighborhood." Although no one has yet come up with the unassailable evidence that chemicals from the dump site have been making people sick, there is enough to convince people that they are being poisoned and that the authorities are more interested in soft-pedaling the problem than in protecting the public's health.

The psychological damage from this long-running disaster may ultimately turn out to rival and perhaps exceed the physical damage. Love Canal has elements in common with two other recent situations. One is the accident at the Three Mile Island nuclear facility. Despite the fact that there were no adverse physical consequences of the release of radioactivity into the environment, a large portion of the population was profoundly alarmed, and ignorance and misinformation from those in charge created a deep and abiding mistrust.

The residents of the canal area may have even more in common with Vietnam veterans who believe their exposure to the dioxin-containing herbicide Agent Orange has led to cancer, birth defects, and a variety of other disorders. In both these instances there are real sicknesses to contend with, and the sufferers feel helpless and betrayed by the government's apparent unwillingness to move swiftly to set things right.

The kind of stress residents of Love Canal have been under is similar in many ways to what happens in the wake of a natural disaster. But there are significant differences. A Red Cross worker says "give us a fire or a tornado or a flood any day." A natural catastrophe is time-limited, and governments generally have well-oiled apparatuses ready to roll in the event of one—witness the generally efficient management of the effects of the Mount St. Helens blowup. But at Love Canal, the nightmare goes on and on. And once the dust finally settles, the residents may spend the rest of their lives wondering when poisons in their systems will erupt and worrying about the effects of exposure on their children and grandchildren. Authorities have been at a loss about how to handle the immediate situation, not to mention the long-term one. As the Love Canal Homeowners Association has observed, "there is no policy which the Love Canal situation fits."

The Niagara Falls Community Mental Health Center has tried valiantly to relieve distress, deploying three outreach workers full-time in the Love Canal neighborhood. They put together a special pamphlet for Love Canal residents on "coping with stress" and publicized various counseling programs. But people who have chosen to avail themselves of these services probably number no more than 100. The residents are mostly blue-collar workers, the men employed in chemical plants or auto parts manufacturing, who attach stigma to mental disorders and who in any case would tend to ascribe their problems to the obvious causes of health and financial difficulties.

Thus, it appears that the Love Canal Homeowners Association, formed in

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