

Chemical Pesticides

Health Effects Research



1100 gallons of chemical pesticides are soaked into the soil per 1000 square feet of home area prior to pouring of concrete foundation. Research now shows these chemicals enter into the home years later and are breathed continuously by home occupants. Building a new home? Use alternative methods to this procedure.

Important health effects research regarding common pesticides are reported in the medical journal summaries below. The majority of information was acquired by extensive research from the University of Florida and University of South Florida Medical Libraries.

The information below provides solid evidence linking common pesticides to early onset of major health problems. Some individuals have lower levels of cytochrome P-450 liver detoxification enzymes which would predispose them to accelerated damage from exposure to chemical pesticides (*Harry Gelboin - National Cancer Institute*).

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Birth Defects Higher in Babies Born to Families Living near Farming Areas using Pesticides

SOURCE: Environmental Health Perspectives
Volume 111(9):1259-1264, July, 2003

Babies born to families living near wheat growing agricultural areas using chemical pesticides have been found to have a 65% greater risk of having birth defects related to the circulatory/respiratory system. The pesticide category believed to be the culprit is known as chlorophenoxy herbicides that contain the chemical 2,4-D. Chlorophenoxy herbicides are used to kill a variety of weeds and are also commonly used by city and county maintenance departments for grass and weed control along roads, canals etc. Other conclusions of the study found there was over a 100% increase in respiratory/circulatory birth defects in babies if heart malformations were excluded. When looking at musculoskeletal/intergumental anomalies for both sexes in the high-wheat growing counties, there was a 50% increased risk of these types of defects. Infant deaths for male babies (from congenital anomalies related to the birth defects) was over 2.5 times higher than normal. Scientists also found that infants conceived from April-June (the time of primary pesticide application) had a 75% increased risk of being diagnosed with birth defects - compared to birth defect rates for conception during other times of the

year.

In conclusion, the scientists stated - "*These results are especially of concern because of widespread use of chlorphenoxy herbicides.*"

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Mosquito Control - Lawn & Agricultural Pesticides Linked to Immune System Weakening and Frog Mutations

SOURCE: Article below appeared in the San Francisco Chronicle
by Carl T. Hall, Chronicle Science Writer
Original journal article appeared in

Proceedings of the National Academy of Sciences: 99(15):9900-9904, July 23, 2002

Raising new questions about the environmental risks of some widely used farm chemicals, scientists are reporting today the first evidence linking agricultural runoff to grotesque hind-limb deformities in frogs. Researchers said frogs appear to be made more vulnerable to a common parasite when exposed to the pesticides atrazine and malathion. The parasite, a burrowing trematode worm, tends to infect the hindquarters of developing tadpoles. Atrazine is part of a family of chemicals that rank among the world's most widely used weed killers. Malathion is commonly applied to control mosquitoes and other insects, and pharmaceutical grades are approved for killing head lice. Both products are controversial but considered safe for commercial use in the United States.

At last count, wild frogs with missing or extra hind limbs have been observed in at least 43 states and five Canadian provinces. Earlier studies clearly implicated the trematode parasite but left open the question of what might be causing the apparent increase in the problem.

The latest study, by ecologist Joseph Kiesecker at Pennsylvania State University and edited by UC Berkeley amphibian specialist David Wake, tries to fit in the key remaining puzzle piece. The study appears in the early edition of this week's Proceedings of the National Academy of Sciences.

Kiesecker said his observations of the common wood frog *Rana sylvatica* in the wild, followed by controlled studies in his laboratory, produced "compelling" evidence that pesticides can weaken the immune system of exposed amphibians -- even at very low concentrations -- making the frogs more vulnerable to parasites.

The field studies showed "considerably higher rates of limb deformities where there was pesticide exposure," Kiesecker said in an interview. "Then the lab experiments helped support the mechanism for what we saw in the field."

He also looked at another pesticide, a synthetic chemical called esfenvalerate, but did not find the same links to growth anomalies as seen with malathion and atrazine.

For the latter two chemicals, significant effects were seen even at concentrations considered safe for drinking water by the Environmental Protection Agency.

Even these very low levels of exposure could produce "dramatic effects on the immune response" of the animals. And that, in turn, led to significantly more growth defects.

Kiesecker stopped short of endorsing any effort to further restrict use of atrazine and malathion. But he said his results underscored the importance of studying toxic chemical effects in a context approaching the complexity found in natural ecosystems.

In this case, he explained, the two farm chemicals "disturbed host-pathogen interactions" with sometimes devastating effects. But all that would be missed in traditional studies examining only the chemicals and the frogs in isolation.

Some other scientists, backed by the farm-chemical industry, challenged Kiesecker's results. Although they said the new study was intriguing, they suggested the details couldn't be trusted until corroborated independently.

Original Journal Article Author Information:
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Non-Hodgkins Lymphoma Linked to Pesticides & Chemicals

SOURCE: Annals of Oncology, 5(1):S19-S24, 1994

Introduction: Non-Hodgkin's Lymphoma (NHL) is a blood cancer that continues to increase rapidly in industrialized countries. NHL is considered similar to leukemia by many experts but is characterized by exceptionally high numbers of "lymphocyte" white blood cells that are manufactured in the body's lymph glands.

Below is the abstract from this article:

The epidemiology of Non-Hodgkin's lymphoma (NHL) was reviewed. In the United States, the annual incidence of NHL rose from 5.9 per 100,000 people in 1950 to

9.3 per 100,000 in 1975, to 13.7 in 1989. The elderly showed the greatest increase. Most of the recent increase was not attributable to acquired immune deficiency syndrome. Mortality rates due to NHL were increasing at almost 2% per year. The largest proportional increases occurred in the brain and other areas of the nervous system. Occupational studies have indicated that persons with certain jobs have an increased risk, including farmers, applicators of pesticides, grain millers, wood and forestry workers, chemists, cosmetologists, machinists, printers, and those working in the petroleum, rubber, plastics, and synthetics industries. A three to nine fold increased risk of developing NHL was noted for patients receiving treatment with alkylating agents or radiotherapy. The most extensive data related to pesticides and the occurrence of NHL suggest that exposure to phenoxy herbicides, particularly 2,4-D (94757), is linked to NHL. Flour millers exposed to fungicides and fumigant pesticides had over a four fold increased risk of NHL; long term followup indicated this risk increased to nine fold. An etiologic link between exposure to various solvents and NHL has been defined by recent studies including benzene (71432), styrene (100425), 1,3-butadiene (106990), trichlorethylene (79016), perchloroethylene (127184), creosote (8021394), lead-arsenate (10102484), formaldehyde (50000), paint thinners, and oils and greases. Recent findings also indicated an increased risk of NHL in those exposed to dusts and particles, hair dyes, and cigarette smoke. An association was noted between NHL and *Helicobacter-pylori* infection. Nitrate contamination of groundwater also may be linked to increased incidences of NHL.

Mosquito Repellant DEET Linked to Neurological Damage

SOURCE: Environmental News Service, May 10, 2002

DURHAM, North Carolina, May 10, 2002 (ENS) - A common ingredient in mosquito and tick repellents may be linked to some neurological problems, a new study suggests.

A Duke University Medical Center pharmacologist is recommending caution when using the insecticide DEET, after his animal studies last year found the chemical causes diffuse brain cell death and behavioral changes in rats after frequent and prolonged use

Mohamed Abou-Donia, PhD has called for further government testing of the chemical's safety in short term and occasional use, particularly in view of Health Canada's recent decision to ban products with more than 30 percent of the chemical.

Every year, about one-third of the U.S. population uses insect repellents containing DEET, available in more than 230 products with concentrations up to 100 percent. While the chemical's risks to humans are still being intensely debated, Abou-Donia says his 30 years of research on pesticides' brain effects indicate the need for

caution among the general public.

His numerous studies in rats, two of them published last year, demonstrate that frequent and prolonged applications of DEET cause neurons to die in regions of the brain that control muscle movement, learning, memory and concentration. Rats treated with an average human dose of DEET - 40 milligrams per kilogram body weight - performed far worse than control rats when challenged with physical tasks requiring muscle control, strength and coordination.

Such effects are consistent with physical symptoms in humans reported in the medical literature, such as those experienced by some Gulf War veterans, said Abou-Donia.

"If used sparingly, infrequently and by itself, DEET may not have negative effects - the literature here isn't clear," Abou-Donia said. "But frequent and heavy use of DEET, especially in combination with other chemicals or medications, could cause brain deficits in vulnerable populations."

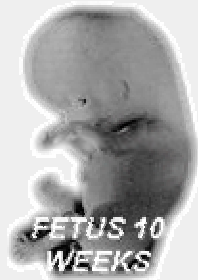
Children are at particular risk for subtle brain changes caused by chemicals in the environment, because their skin more readily absorbs them, and chemicals may affect their developing nervous systems, said Abou-Donia.

Preparations like insecticide based lice killing shampoos and insect repellents are assumed to be safe because severe consequences are rare in the medical literature. Yet subtle symptoms, such as muscle weakness, fatigue or memory lapses, might be attributed to other causes in error, Abou-Donia said.

"The take home message is to be safe and cautious when using insecticides," said Abou-Donia. "Never use insect repellents on infants, and be wary of using them on children in general. Never combine insecticides with each other or use them with other medications. Even so simple a drug as an antihistamine could interact with DEET to cause toxic side effects. Don't spray your yard for bugs and then take medications. Until we have more data on potential interactions in humans, safe is better than sorry."

Fetal Deaths Linked to Living Close to Agricultural Pesticide Use During Weeks 3-8 of Pregnancy

SOURCE: Epidemiology, 12(2), March 2001



Approximately 19,000 fetal deaths (stillborn) occur each year in the United States. The causes of these deaths remains unclear. Researchers from the University of North Carolina and the National Cancer Institute (NCI) worked together in this study of over 600 children to determine what part local pesticide use plays in increasing the risk of having a late fetal death after 5 months of pregnancy. Using maps and records of pesticide use, the researchers divided mothers into categories according to how close they lived to pesticide applications. If they lived within 1 mile of an agricultural pesticide application that occurred between weeks 3-8 of gestation they were considered as "exposed." Weeks 3-8 during pregnancy were selected since this is the critical period in which formation of organs and limbs are occurring. **Results of this study showed there was approximately 2-fold greater risk of having a stillbirth if the mother lived within 1 mile from an agricultural area which used organophosphate - pyrethroid - carbamate - or chlorinated pesticides.** Primary defects which contributed to the death of the child were urinary system and multiple congenital anomalies.

CHEM-TOX COMMENT: This research is particularly important because it is the first to determine risk if limiting exposure to the 3-8 week gestational period, thereby demonstrating true risk to pregnant mothers in schools, homes, offices and neighborhood mosquito control projects. Other studies would have diluted results since they have been done on a trimester basis. Also of great concern is the increased risk stated here for having a stillborn child after exposure to pyrethroid pesticides. Pyrethroid based pesticides are the main pesticide used for mosquito control truck applications and should therefore, raise concerns regarding exposure to pregnant women living in mosquito spray areas.

This is not the first study to find a link between pesticides and fetal defects - another study reported in Epidemiology, 10:60, 1999, found pregnant mothers had a 70% increased risk for congenital defects if home pesticides were used or if living within a quarter-mile of an agricultural crop during the month before conception and the first trimester of pregnancy.

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Neuroblastoma Linked to Homes Treated with Pesticides

SOURCE: Epidemiology: 12(1):20-26, January, 2001

One of the largest studies to date has found that pesticide use around the home can more than double the chance of a child developing neuroblastoma.

Neuroblastoma accounts for approximately 10% of all childhood tumors. There are 550 new cases in the United States each year, with an annual incidence rate of 9.2 cases per million children under 15 years of age. This works out to approximately 1 per 100,000 children under age 15 on a national level. (These rates were reported in the book "Principles and Practice of Pediatric Oncology, Lippincott-Raven, 1997). It is a very serious cancer as approximately 60% of children over age 1 who develop neuroblastoma do not live 3 years even when receiving treatments of radiation and chemotherapy. Children under age 1 have a more positive prognosis. As statistics show that neuroblastoma rates have increased over the past 50 years, it is reasonable to assume environmental factors may be involved.

One of the largest collaborative efforts among 7 Universities and medical facilities worked together to determine what extent pesticide use in the home could increase child neuroblastoma rates. 390 neuroblastoma children and 460 non-cancer controls were included in the study. Investigators questioned both parents regarding use of pesticides in and around the home.

Results showed that using pesticides in and around the home resulted in a 60% increased likelihood of children developing the disease (Odds Ratio=1.6). Looking at pesticide use for the lawn and garden only resulted in an increased risk of 120% (Odds Ratio=2.2) when the mother had applied pesticides in the yard and 50% higher (Odds Ratio=1.5) when the father had applied pesticides in the yard. (Chem-Tox Note: Outdoor pesticides are much different from indoor pesticides as they include fungicides and herbicides some of which have been reported to contain dioxin).

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Pesticide Exposure Increases Miscarriage Risk

SOURCE: Epidemiology, March 2001

Living close to areas where agricultural pesticides are applied may increase the risk of fetal death from birth defects according to research conducted at the University of North Carolina at Chapel Hill. The study, which involved almost 700 women in 10 California counties, showed an increased risk of death among developing babies. Mothers who lived near crops where certain pesticides were sprayed faced a 40 to 120 percent increase in risk of miscarriage due to birth defects.

"Our study showed a consistent pattern with respect to timing of exposure," said Dr. Erin Bell, who earned her doctorate with the research at the University of North Carolina (UNC) School of Public Health. "The largest risks for fetal death due to birth defects were from pesticide exposure during the third week to the eighth week of pregnancy."

"The risks appeared to be strongest among pregnant women who lived in the same square mile where pesticides were used," she said.

"This is the first study to our knowledge of pesticides and pregnancy in which exposures were in close proximity to the subjects and the verification of pesticide use was objective, not relying on people's memories of what they might have been exposed to," Hertz-Picciotto said.

About 19,000 fetal deaths occur in the United States each year, and the causes remain a significant public health problem, Bell said. Among known risk factors are smoking, advanced age among pregnant women and previous history of fetal deaths.

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Indoor Pesticide Use Increases Child Cancer Rates

SOURCE: CANCER:89:11, 2000
(An International Publication of the American Cancer Society)

Children who have been exposed to household insecticides and professional extermination methods within the home are three to seven times more likely to develop non-Hodgkin lymphoma (NHL) compared with children who have not been exposed to pesticides. These are the results of a study published in the December 1, 2000 issue of the journal CANCER, an international publication of the American Cancer Society. The study indicated that a child's risk of developing NHL was similar for both maternal exposure to pesticides during pregnancy (in utero) and direct (postnatal) exposure to pesticides. Significant variations in risk were

associated with various NHL morphologies. For instance, the use of household insecticides increased the risk of lymphoblastic lymphoma by 12.5 times. The term "pesticides" refers to a group of chemicals that have in common their ability to kill insects, plants, mammals (particularly rodents), or fungi.

"A limited number of these compounds may be capable of inducing lymphoma, particularly when used around the home," comments chief researcher Jonathan D. Buckley, M.B.B.S., Ph.D., from the Department of Preventative Medicine at the University of Southern California in Los Angeles. Lymphoma, the third most common childhood malignancy, occurs at a rate of 21.7 per million in children age < 15 years. Approximately 60% of these cases are NHL. In the current study, the Children's Cancer Group evaluated the correlation between home pesticide use or occupational exposure to pesticides and the incidence of NHL in a pediatric study sample.

The study included children and adolescents age < 20 years who were diagnosed with NHL between February 1986 and June 1990. Tumors were classified according to cell type (predominantly B-cell or T-cell). Telephone interviews with the participants' mothers included questions regarding occupational and home exposure to pesticides around the time of pregnancy and direct exposure of the child to pesticides. From a total of 268 NHL pediatric cases examined, 49 of the patients had lymphomatous leukemia, whereas the other 218 patients were diagnosed with various NHL morphologies, including lymphoblastic subtype (38%), Burkitt lymphoma (28%), undifferentiated (non-Burkitt) lymphoma (12%), and large-cell NHL (19%). Frequency of household insecticide use by the mothers around the time of the pregnancy (in utero) was associated with a 2.62-fold greater risk of NHL for limited applications (1-2 days per week), compared with a 7.33-fold greater risk for regular use (on most days). Professional home extermination was related to a 3-fold greater risk for developing NHL. Direct (postnatal) exposure of the child to pesticides was associated with a 2.4-fold greater risk, whereas occupational exposure and the use of pesticide sprays in the garden demonstrated an increased risk, although not statistically significant. When the researchers focused their analysis on the association between different types of pesticide exposure and the development of different NHL morphologies, they observed the risk for developing lymphoblastic lymphoma was 12.5 times greater after a child's exposure to household insecticide use. The risk of developing Burkitt lymphoma was observed to be 9.6 times greater after occupational exposure to pesticides. The risk for developing large cell lymphoma or Burkitt lymphoma was 6.7 and 8.0 times higher, respectively, after professional insect extermination. The authors note that the most statistically significant correlation between exposure to pesticides and the risk for developing NHL were observed for those children who were directly exposed to pesticides. The risk for developing lymphoblastic subtype lymphoma and large cell non-Hodgkin's lymphoma was 10.9 times and 6.5 times greater, respectively, for these children compared with children who have not been exposed to pesticides. The researchers also noted a 7.1 times greater risk for Burkitt lymphoma among these children. Overall elevations in the risk associated with pesticide exposure

were present for both the younger (age < 6 years) and older (age > 6 years) study participants.

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Evidence Suggests Child Brain Development Harm During Pregnancy from Common Pesticide Chlorpyrifos (Dursban)

SOURCE: Toxicology and Applied Pharmacology 134, 53-62, 1995

Chem-Tox Comment: During the past 30 years there has been an alarming rise in the rates of children exhibiting various forms of subtle brain damage including including - learning disabilities - autism - and attention deficit disorder. Understanding that the human brain begins growing at over 4,000 cells per second beginning in the 4th week of pregnancy demonstrates the importance of having a clean biological environment in order to attain maximum brain growth quality. The following research was conducted at the Department of Pharmacology, Duke University Medical Center, Durham, North Carolina. The first paragraph below is taken from the abstract of the original research.

"Researchers administered chlorpyrifos to neonatal rats in apparently subtoxic doses that caused no mortality and little or no weight deficits and examined developing brain regions (cerebellum, forebrain, brainstem) for signs of interference with cell development. One day old rats given 2 mg/kg of chlorpyrifos showed significant inhibition of DNA synthesis in all brain regions within 4 hours of treatment; equivalent results were obtained when a small dose (0.6 ug) was introduced directly into the brain via intracisternal injection, indicating that the actions were not secondary to systemic toxicity. Inhibition of DNA synthesis was also seen at 8 days of age; however, at this point, there was regional selectivity, with sparing of the cerebellum... These results indicate that low doses of chlorpyrifos target the developing brain during the critical period in which cell division is occurring, effects which may produce eventual cellular, synaptic, and behavioral aberrations after repeated or prolonged subtoxic exposures."

In summary the researchers stated,

"In extrapolating findings in developing rat brain to man, it is important to note that the first 10 days of postnatal life in the rat represent stages of neurodevelopment corresponding to the last trimester of gestation in man; thus, our finding of a much greater sensitivity to chlorpyrifos in the neonate, in terms of both systemic toxicity and targeting of DNA and protein synthesis within the brain, emphasize the need for caution in assigning safety standards. Further study of acute and chronic exposure to chlorpyrifos should be undertaken to evaluate the cellular, synaptic, and behavioral consequences of low-level exposures.

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Common Weed Killer (Roundup) Shows Evidence of Environmental and Health Problems

SOURCE: Organic Gardening, July, 2000

Thousands and thousands of acres in the United States are being sprayed annually with nearly 50 million pounds of Roundup, a broad-spectrum herbicide designed to kill any plant it hits, unless the plant has been genetically altered to tolerate the chemical. Roundup has accounted for half of Monsanto's corporate profits in recent years. Now the company has expanded its Roundup market by genetically engineering "Roundup Ready" soybeans, corn, and other crops. Monsanto's advertising campaigns have convinced many people that Roundup is safe, but the facts simply do not support that conclusion. Independent scientific studies have shown that Roundup is toxic to earthworms, beneficial insects, birds and mammals. Plus it destroys the vegetation on which they depend for food and shelter. And although Monsanto claims that Roundup breaks down into harmless substances, it has been found to be extremely persistent, with residue absorbed by subsequent crops over a year after application. Roundup show adverse effects in all standard categories of toxicological testing, including medium-term toxicity, long-term toxicity, genetic damage, effects on reproduction, and carcinogenicity. Here is some of the research that demonstrates the ways that Roundup's active ingredient, glyphosate, adversely affects plants and animals:

In a study conducted by T.B. Moorman and colleagues at the USDA Southern Weed Science Laboratory in Stoneville, Mississippi, glyphosate reduced soybeans' and clover's ability to fix nitrogen. A study conducted by G.S. Johal and J.E. Rahe of the Center for Pest Management at Simon Fraser University in Burnaby, British Columbia, found that glyphosate made bean plants more susceptible to disease. At Dalhousie University in Halifax, Nova Scotia, D. Estok and colleagues found that glyphosate reduces the growth of beneficial soil-dwelling mycorrhizal

fungi. Moving up to mammals, sperm production in rabbits was diminished by 50 percent when they were exposed to glyphosate, in research conducted by M.I. Youset and colleagues at the University of Alexandria in Egypt and the University of Tromso in Norway. Brand-new evidence suggests that Roundup may cause cancer. The study, published in *Environmental and Molecular Mutagenesis* (vol. 31 pp. 55-59, 1998), found that an unidentified chemical in Roundup caused genetic damage in the livers and kidneys of mice exposed to the herbicide. The researchers believe additional experiments are needed to determine which chemical in the Roundup mixture is causing the damage. They point out that this will be very difficult because "the precise composition of the mixture...is not available due to protection by patent regulation." In other words, Monsanto doesn't have to reveal to the public exactly what chemicals are in Roundup. In California, where pesticide-related illness must be reported, Roundup's active ingredient (glyphosate) was the third most commonly reported cause of pesticide illness among agricultural workers, and the most common cause of pesticide illness in landscape workers. According to two New Zealand toxicologists, the symptoms experienced by workers exposed to Roundup included eye and skin irritation, headaches, nausea and heart palpitations.

Parkinson's Disease Mortality Higher in Agricultural Areas

SOURCE: *Biochem Soc Trans*, 28(2):81-4, 2000

BACKGROUND: In the last two decades reports from different countries emerged associating pesticide and herbicide use with Parkinson's disease (PD). California growers use approximately 250 million pounds of pesticides annually, about a quarter of all pesticides used in the US. **METHODS:** We employed a proportional odds mortality design to compare all cases of PD recorded as underlying (1984-1994) or associated causes (1984-1993) of death occurring in California with all deaths from ischaemic heart disease (ICD-9 410-414) during the same period. Based on pesticide use report data we classified California counties into several pesticide use categories. Agricultural census data allowed us to create measures of percentage of land per county treated with pesticides. Employing logistic regression models we estimated the effect of pesticide use controlling for age, gender, race, birthplace, year of deaths, and education. **RESULTS:** Mortality from PD as the underlying cause of death was higher in agricultural pesticide-use counties than in non-use counties. A dose response was observed for insecticide use per county land treated when using 1982 agricultural census data, but not for amounts of restricted pesticides used or length of residency in a county prior to death. **CONCLUSIONS:** Our data show an increased PD mortality in California counties using agricultural pesticides. Unless all of our measures of county pesticide use are surrogates for other risk factors more prevalent in pesticide use counties, it seems important to target this prevalent exposure in rural California in future studies that use improved case finding mechanisms and collect pesticide exposure data for

individuals.

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Parkinson's Disease Linked to Pesticide Combination

SOURCE: Journal of Neuroscience, December 15, 2000

A combination of two commonly used agricultural pesticides, when injected into mice, causes the same pattern of brain damage seen in Parkinson's disease, researchers said on Thursday.

Mice given the herbicide paraquat and the fungicide maneb showed clear signs of Parkinson's, a progressive and incurable brain illness, Deborah Cory-Slechta and colleagues at the University of Rochester School of Medicine and Dentistry said.

But neither chemical alone works to create the distinctive pattern of brain damage.

The findings add to a growing body of evidence that exposure to chemicals such as pesticides may at least contribute to the brain damage seen in Parkinson's.

“No one has looked at the effects of studying together some of these compounds that, taken by themselves, have little effect,” Cory-Slechta said in a statement.

“This has enormous implications.”

Dr. Eric Richfield, a neurologist who worked on the study, said it may mean that no one will ever be able to predict who is at risk of Parkinson's based on exposure to chemicals.

“There is no way to add up how much of any chemical someone is exposed to,” Richfield said in a telephone interview.

“There are so many agents and everybody is a little different. Person A may have no reaction to a particular compound. How do you test for interactions between two agents?”

Parkinson's disease, which affects an estimated 500,000 people in the United States alone, is a progressive and incurable disease that involves the destruction of brain cells that produce dopamine, an important message-carrying chemical linked with movement.

Patients start out with tremors and can become paralyzed and die. There is no cure and treatments can delay the disease for a while but eventually stop working.

Perhaps the best-known patient is Pope John Paul (news - web sites) II, whose doctor admitted on Wednesday the pontiff had the disease. Actor Michael J. Fox also has Parkinson's, and boxer Muhammad Ali has symptoms of the disease.

Researchers suspect that a combinations of genetic vulnerability and exposure to something in the environment may be responsible. One major suspect is organophosphate pesticides, which are known to affect the nervous system.

Writing in the Dec. 15 issue of the Journal of Neuroscience, Cory-Slechta's team said they studied the effects of a mixture of paraquat and maneb. Both are used on millions of acres of crops such as potatoes, tomatoes, lettuce, corn, soybeans, cotton and fruit.

Mice injected with one or the other alone showed no ill effects, but when the combination was given they showed clear patterns of brain damage.

The mice moved around much less than normal and had lower levels of an enzyme known as tyrosine hydroxylase that is used as a measure of the health of the dopamine system.

The mice had nearly four times as many "reactive astrocytes," brain cells that suggest they are damaged, they had about 15 percent fewer dopamine neurons, and they produced 15 percent less dopamine than normal mice.

Richfield says his team now plans to test mice genetically engineered to be susceptible to the Parkinson's-like damage, and they may test whether giving the chemicals orally has the same effect.

He thinks one chemical may act to make the other more damaging. "It could have to do with the uptake of paraquat," he said.

"If given systemically (as in an injection), very little gets into the brain. It is possible the maneb compound is promoting transport into the brain, therefore giving the mice a greater dosage to the brain. That is something we are planning to experimentally determine."

University of Rochester School of Medicine

Prostate Cancer Risk Doubles in Pesticide Applicators

SOURCE: Occupational Environmental Medicine, 56(1):14-21, 1999

OBJECTIVES: Although the primary hazard to humans associated with pesticide exposure is acute poisoning, there has been considerable concern surrounding the possibility of cancer and other chronic health effects in humans. Given the huge volume of pesticides now used throughout the world, as well as environmental and food residue contamination leading to chronic low level exposure, the study of possible chronic human health effects is important.

METHODS: This was a retrospective cohort study, analysed by general standardised mortality ratio (SMR) of licensed pesticide applicators in Florida compared with the general population of Florida. A cohort of 33,658 (10% female) licensed pesticide applicators assembled through extensive data linkages yielded 1874 deaths with 320,250 person-years from 1 January 1975 to 31 December 1993.

RESULTS: Among male applicators, prostate cancer mortality (SMR 2.38 (95% confidence interval (95% CI) 1.83 to 3.04) was significantly increased. No cases of soft tissue sarcoma were confirmed in this cohort, and non-Hodgkin's lymphoma was not increased. The number of female applicators was small, as were the numbers of deaths. Mortality from cervical cancer and breast cancer was not increased. Additional subcohort and exposure analyses were performed.

Fleming LE, Bean JA, Rudolph M, Hamilton K
Mortality in a cohort of licensed pesticide applicators in Florida.
Department of Epidemiology and Public Health
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Living Near Agriculture Increases Risk of Brain Cancer

SOURCE: American Journal of Public Health, 86(9): 1289-96, 1996

Living closer than 2600 feet to an agriculture area has been found to increase the risk for developing brain cancer. This 1996 research project studied cancer rates among over 600 people. Brain cancer overall showed a twofold increase risk for people living within the 2600 foot distance. An astounding 6.7 fold increased risk was found for the brain cancer type known as astrocytoma for people living within 2600 feet from an agriculture area.

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Golf Course Superintendents Face Higher Cancer Rates

SOURCE: American Journal of Industrial Medicine, 29(5):501-506, 1996

Working as a Golf Course Superintendent has been found to significantly increase the risk of dying of four cancer types including - brain cancer, lymphoma (non-Hodgkin's lymphoma, NHL), prostate and large intestine cancer. A study was conducted of 686 deceased members of the Golf Course Superintendents Association of America from all U.S. states who died between 1970 and 1992. Brain cancer rates for the Superintendents was found to occur at over twice the national average, while non-Hodgkin's lymphoma also occurred at over twice the national average. Prostate cancer occurred at nearly 3 times the national average and large intestinal cancer occurred at 1.75 times the national average. The researchers stated that a similar pattern of elevated NHL, brain and prostate cancer mortality along with excess deaths from diseases of the nervous system has been noted previously among other occupational groups exposed to pesticides.

**Drs. Kross, B.C., Burneister, L.F., Ogilvie, L.K., Fuortes, L.J.,
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Home Pesticides Increase Risk of Leukemia in Children

SOURCE: Journal of the National Cancer Institute, July 1987

Children who live in homes where indoor or outdoor pesticides are used face a far greater chance of developing leukemia (leukemia is a cancer of the blood). The study, published in July's 1987 issue of the *Journal of the National Cancer Institute*, studied 123 Los Angeles children with leukemia and 123 children without the malignancy. The results showed the children living in the pesticide treated homes had nearly a 4 times greater risk of developing the disease. If the children lived in homes where pesticides were used in the garden as well, the risk of developing leukemia was 6.5 times greater. All of the children in the study were 10 years of age or younger.

**Dr. John Peters
University of Southern California**

Pesticide Vapors Present - Weeks - Months - Years after Application

In research to determine the amount of indoor air contamination following routine indoor application of pesticides, it was found the levels of the pesticide Dursban drop to only one-sixth of its original 1 hour level four days after application. The

research was conducted by Dow Chemical (1). The no-odor pesticide Ficam was reported to have an air half-life of approximately 10 days (2). Of significant concern is the discovery that the pesticide soil drench procedure (**a procedure in which approximately 200 gallons of pesticides are saturated into the soil just prior to the pouring of the concrete foundation in new home construction**) is finding its way into the indoor air for literally years and years after application. It was originally thought that the concrete foundation provided a solid barrier to the poison. However, air testing technology has shown this is not the case (3). Just as radon finds its way into a home, entering from the soil, the pesticide vapors do also moving from the high pressure underneath the home and into the lower pressure inside the home. It enters through cracks in foundation, around plumbing fixtures, etc. This provides strong evidence that this procedure should be eliminated immediately and alternative methods be used. Alternative methods include using only concrete and metal framing - using non-volatile Sodium Borate treatment on the wood framing before installing drywall - using pesticide spikes embedded in the soil around the perimeter of the home (this is still a chemical pesticide and therefore is not a first option but may satisfy the Lenders). Other research at University of Florida has shown that larger "sand" granules do not allow termites to build their nests. Unfortunately, the pesticide industry has worked its way solidly into new home construction practices and therefore takes a little effort on the homeowner's part to stop the pesticide soil drench procedure - (It can be done however, as it is not a law, but rather a recommended procedure in the Southern Building Code and one the lenders like to see done. Go talk to your lender personally and tell them about the alternatives and threaten to take your business somewhere else.). The bottom line is these chemicals do enter the home and they do accelerate the onset of health problems (as seen in the research on this page) including aging of the immune and nervous system and therefore should not be applied underneath the home.

Immune System Problems Appear After Indoor Dursban Exposure

SOURCE: Archives of Environmental Health, 48(2):89-93, March/April 1993

The pesticide Dursban (also called chlorpyrifos), commonly used in indoor and lawn pest control, is now showing evidence of causing immune system disorders in people. In a study by the Department of Health Science at California State University, 12 individuals, which included a teacher, six housewives, a retail owner, a musician and an engineer, were studied for 1 to 4.5 years after they became ill when their home or place of employment was treated with the pesticide. The researchers were investigating for any abnormalities in immune system function. Immediately following each patient's exposure to the pesticide, common complaints included an initial flu-like illness followed by chronic complaints of fatigue, headaches, dizziness, loss of memory, upper and lower respiratory symptoms, joint and muscle pain and gastrointestinal disturbances. The subjects were found to have

an elevated number of CD26 cells and a higher rate of autoimmune problems, compared with two other control groups. (Autoimmune disorders occur when the person's own immune system mistakenly makes antibodies which attack their own body.) Autoantibodies were found toward smooth muscle, parietal cell, brush border, thyroid gland, myelin, and ANA. 83% of the pesticide exposed people were found to have autoantibodies in their blood, in comparison to only 15% for non-exposed control group. 50% of the pesticide exposed people were also found to have two or more autoantibodies in comparison to only 4% for the non-exposed group.

In conclusion the researchers stated,

"the presence of several different types of autoantibodies, e.g., antimyelin, antismooth muscle, anti brush boarder, and antimicrosomal, indicates that generalized tissue injury has occurred. Moreover, these identical observations have been made in additional chlorpyrifos patients (research in progress). Thus, chlorpyrifos (Dursban), as used in pesticide spray, should be examined more closely as a probable immunotoxin."

**Jack D. Thrasher Ph.D., Roberta Madison, Alan Broughton
Department of Health Science, California State University**

Flea Home Treatments Cause High Air Pesticide Levels

SOURCE: American Journal of Public Health, 80(6):689-693, 1990

Applying common flea pesticide treatments to carpets results in illegally high air pesticide levels in homes which lasts for over 24 hours after application. This was the conclusion of research conducted by Dr. Richard A. Fenske, Assistant Professor at Rutgers University. Tests were conducted by applying the common pesticide Chlorpyrifos (Dursban) for flea treatment by a licensed Pest Control Applicator to three rooms of an unoccupied apartment in New Jersey in June, 1987. Air sampling equipment was installed above the floor at the levels expected for an adult sitting in a chair and that of an infant. After application, samples were taken at 30 minutes, 1 hour, 1.5 hours, 3 hours, 5 hours, 7 hours and 24 hours. Results showed that at 5 hours post application, indoor air levels of the pesticide was nearly twice above the legal limit in homes with ventilation (an open window) and over 6 times above the legal limit at 7 hours where windows were closed. Levels at the infant breathing zone were nearly 10 times above the legal limit at 7 hours and over 3 times the legal limit even after 24 hours. These results show it is incorrect when Pesticide Applicators state it is safe to return home several hours after application. In fact, levels at 7 hours were 3-5 times higher than the 1.5 hour level. In conclusion the

researchers stated,

"Despite uncertainties in exposure/absorption estimates and toxicological interpretation, the dose values derived in this study raise a public health concern. Broadcast applications and possibly total release aerosol/fogging applications of acutely toxic insecticides may result in dermal and respiratory exposures sufficient to cause measurable toxicological responses in infants.

Richard A. Fenske, Ph.D., MPH

Kathleen G. Black, MPH

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Department of Environmental Sciences

Graduate Program in Public Health, Rutgers University

Pesticide Inhalation Associated with Brain and Lung Cancer

SOURCE: Journal of the National Cancer Institute, 71(1), July 1983

A study of 3,827 Florida pesticide applicators employed for 20 or more years found they had nearly 3 times the risk for developing lung cancer. The same study also showed the pesticide applicators had twice the risk for brain cancer. There was not any increased cancer risk when applicators were studied for only 5 years implying it takes over 5 years to accumulate enough damage to the genetic structure to develop the cancers.

Brain Damage Linked to Lawn Pesticides

SOURCE: 3 references listed below

The pesticide MCPA, used as an ingredient in some lawn pesticides, has been found to damage a part of the brain known as the *blood brain barrier* (1). The blood brain barrier is the brain's primary defense system which works to keep toxic substances out of the brain cells and is literally protecting all of us from developing immediate neurological illness. The blood brain barrier has been found to be defective more often in patients with Alzheimers and some psychiatric disorders (2). In fact, the lack of functioning of the blood brain barrier in the human infant has been reported on many occasions as being the reason why an infant is being found to develop brain damage after exposure to common chemicals while an adult with a mature blood brain barrier does not. Unfortunately, EPA neurotoxicologist Dr. Bill

Sette stated EPA does not yet require chemical companies to test any of their pesticides for causing blood brain barrier damage. Another study of 56 men exposed to organophosphate pesticides detected memory problems and difficulty in maintaining alertness and focusing attention (3). Each of these studies will be listed here in greater detail shortly as our web site completes development. As the understanding of blood brain barrier function is of critical importance to understanding why one individual can receive more damage to his/her nervous system than someone else, we will also include a blood brain barrier site with the address www.chem-tox.com/bbb.

1. *Toxicology and Applied Pharmacology*, 65:23, 1982
2. *British Journal of Psychiatry*, 141:273, 1982
3. *Annual Reviews in Public Health*, 7:461, 1986

Common Birth Defects Increase After Pesticide Exposure - Hydrocephaly & Cleft Palete

SOURCE: Bulletin of Environmental Contamination Toxicology, 54:363-369, 1995

Of the many different types of pesticides (which include insecticides, herbicides and fungicides), it was found that the common fungicide "cyproconazole" caused serious defects when administered to test animals. This chemical is reported to be widely used in agriculture and is a member of the family of fungicides known as triazole fungicides. It's closely related family members include the fungicides triadimefon, triadimenol, bitertanol, flusilazole, 1,2,4-triazole, and propiconazole. Each of these pesticides were reported in this article as being capable of causing birth defects in test animals when administered at doses as low as 30 mg/kg. These chemicals are far more toxic than even standard insecticides. The "No Observable Effect Level" (which means the maximum amount of the chemical that test animals can be exposed to without seeing any adverse effects) is reported to be only 2 mg/kg for flusilazole.

The study on the effects of cyproconazole (lets call it CPZ for simplicity) was headed by Dr. K. Machera, at the Laboratory of Pesticide Toxicology in Athens, Greece. Dr. Machera exposed 10 pregnant animals to different levels of CPZ ranging from 20-75 mg/kg from the 6th to the 16th day of pregnancy. On the 21st day of pregnancy the animals were sacrificed and the number of implantations, resorption sites and live and dead fetuses were recorded. The fetuses were weighed and examined for abnormalities.

Results showed the number of resorptions (similar to an early miscarriage) was over 8 times greater for the posed to the 50 and 75 mg/kg doses. The fetal length was significantly smaller in doses from 50 mg/kg up. The fetal body weight was

significantly less even at the lowest dose of 20 mg/kg.

Cleft Palate did not occur in any of the 100 offspring not exposed to CPZ. However, cleft palate did occur in 2% of posed to 20 mg/kg of CPZ, 20% of posed to 50 mg/kg of CPZ and 91% of posed to the highest 100 mg/kg dose.

The same trend was also seen with hydrocephalus - 0% for the animals not exposed to CPZ, 6% for posed to 20 mg/kg, 19% for posed to 50 mg/kg, 32% for posed to 75 mg/kg and 100% for the 12 posed to the 100 mg/kg level.

These studies demonstrate the definite potential for pesticides in the triazole family to increase the risk of lower birthweight, lower body length, as well as strongly increasing the risk of cleft palate and hydrocephalus. With results such as this in test animals, it would certainly be worthwhile to investigate the incidence of these conditions among people living in close proximity to agricultural areas. Dr. Machera did not state if these chemicals were used on residential lawns as an anti-fungal agent. Keep in mind that these studies were looking for physical defects and were not looking for neurological defects in offspring (which typically occur at much lower dosages).

Dr. K. Machera
Laboratory of Pesticide Toxicology
Benaki Phytopathological Institute, Athens, Greece

Common Lawn Pesticide Linked to Cancer

The lawn pesticides, mancozeb and chlorothalonil (used by commercial lawn spray companies as fungicides), have been classified by EPA as "probable" cancer causing chemicals in humans as they have been found to cause cancer in animals (1). Mancozeb has also been found to react with sunlight to form a new compound EPA categorizes as a "known" human carcinogen (1). The common lawn pesticide 2,4-D has been shown to increase the risk of lymphatic cancer in farmers six times the normal rate according to a National Cancer Institute report (2).

1. ***Newsweek, May 16, pg.77, 1988***
2. ***Science News, September 13, 1986***

The Pesticide Chlordane Contaminates Most U.S. Homes

SOURCE: Teratogenesis, Carcinogenesis, and Mutagenesis 7:527-540, 1987

There is approximately a 75% chance you are breathing the pesticide chlordane every minute you are inside your home if your home was built before March of 1988. Other studies have shown there is a 6-7% chance you are breathing dangerously high levels of the pesticide which are above the guidelines set by the National Academy of Sciences. This problem is occurring because over 30 million homes were treated with the chemical prior to its being banned by the EPA in March of 1988. The air chlordane studies were conducted by the U.S. Air Force and the New Jersey Department of Environmental Regulation. Over 1000 homes and apartments were tested in different parts of the nation. The researchers stated they expect the figures to remain the same throughout the country because of standardized application practices by the pest control companies. If you would like more detailed information on the chlordane problem and the health effects suspected for the millions of Americans living in chlordane treated homes -

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Common Pesticides Cause Hyperactivity in Test Animals After Single Dose

SOURCE: Neurotoxicology and Teratology, Vol. 11:45-50, 1989

Groups of test posed to different pesticides used in agriculture and lawn care showed over 50% more activity following a single exposure to the chemical. One of the main goals of this experiment, conducted by Dr. J. A. Mitchell and colleagues at the University of Michigan, was to investigate activity behavioral changes in test animals (male Swiss mice) following a single exposure to one of 4 different dosages of weed killers and fungicides. The chemicals used included Lasso (containing alachlor), Basalin (containing fluchloralin), Premiere (containing dinoseb) and the fungicide Maneb-80 (80% Maneb).. Test dosages ranged from a very low .4 mg/kg to 4 mg/kg to 40 mg/kg. Even the largest dose was still below the LD-50 for the animals (the amount needed to kill 50% of the test animals). According to the researchers, the herbicides and fungicides have received few reports investigating their toxicity while their yearly growth and production have grown far more than the insecticides.

The detection of hyperactivity was measured by placing the test animals in steel cages that were equipped with electronic motion detectors which used infrared beams to count specific movements by the animals. After the single chemical exposure, activity was measured for a 4 hour period. Results showed the weed killer

"Lasso" did not show any effects at the very low .4 mg/kg level but did show over a 65% increase in activity at the low 4 mg/kg and a 75% increase at the higher 40 mg/kg level. The weed killer Dinoseb also showed no activity increases at the lowest .4 mg/kg dose but did show a 15% increase at the 4 mg/kg level and a 54% increase at the larger 40 mg/kg level. Other researchers have reported that activity provides a sensitive measure for evaluating the behavioral effects of the pyrethroid pesticide, deltamethrin, at doses that did not cause the characteristic neurotoxicological syndrome (6).

In conclusion the researchers stated,

"The results of this study suggest that at least some herbicides, in addition to pyrethrins, organophosphate, and carbamate pesticides, can produce behavioral manifestations following accidental exposure... The effects of the pesticides on activity also support the hypothesis that these agents may affect the central nervous system."

Dr. J. A. Mitchell, S. F. Long
Dept. of Pharmacology, University of Mississippi
The Behavioral Effects of Pesticides in Male Mice

Chlordane Causes Neurological Disorders and A.D.D. Symptoms

SOURCE: Environmental Health Perspectives, 103:690-694, 1995

In 1987, over 250 adults and children were exposed to the pesticide chlordane when the wooden building surfaces and soil around their apartment complex was sprayed. Their exposure came from the vapors that entered into their home for the years after the chemical's application. Levels inside the homes were reported above 0.5 mg/m³.

In June-September 1994, 216 adult occupants or former residents of the apartment complex were examined by researchers at the University of Southern California School of Medicine in Los Angeles. The 109 women and 97 men were given a battery of neurological tests to determine if the low levels of chlordane in their apartments was causing any harmful effects. The tests given are considered sensitive indicators of neurotoxicity. To determine if chlordane was in fact causing neurological problems, the test scores of the chlordane exposed adults were compared to the test scores of 94 women and 68 men from Houston, known not to have been exposed to chlordane.

Results of the testing showed many negative effects upon mental function from the low levels of air chlordane. Not only were test scores lower for reaction time, balance, and memory, but also worse scores were observed in the test checking for attention deficits (digit symbol) and all tests of mood scores including tension,

depression, anger, vigor and fatigue.

Going beyond the neurological testing, both groups were also investigated for many common symptoms and illnesses. Those which were significantly more common in the chlordane exposed group included asthma, allergies, production of phlegm, chronic bronchitis by Medical Research Council criteria, and wheezing with and without shortness of breath. Headaches and indigestion were also more common among the chlordane exposed individuals.

In summary Dr. Kilburn and Thornton summarized their findings by stating,

"The exposure of our study group appears to be from indoor air, due to the outgassing of chlordane from the wooden surfaces of the apartment complex... Examination of subjects exposed in their homes to chlordane as compared to referent subjects showed significant, and we suggest important, impairment of both the neurophysiological and psychological functions including mood states. Accompanying these changes were significant differences in symptom frequency and in respiratory rheumatic and cardiovascular disease symptoms. The most notable changes were slowing of reaction time, balance dysfunction as revealed by increased sway speed, reduction in cognitive function, perceptual motor speed, and immediate and delayed verbal recall... The neurobehavioral impairments measured in this environmental epidemiological study were similar to those noted in patients exposed to chlordane at home. These impairments include probably irreversible dysfunction of the brain. Possible effects on trigeminal nerve-pons-facial nerve function were suggested for the first time. Confirmatory studies, including follow-up after removal from exposure, are urgently needed. Meanwhile, chlordane use should be prohibited worldwide."

This study should generate heightened concern because of the large number of neurological and health effects seen at chlordane air levels of above 0.5m g/m³ (typical levels for most U.S. homes) and statements by researchers that developing children are harmed more by chemicals than adults.

**Dr. Kaye H. Kilburn and John C. Thornton
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Male Infertility After Pesticide Chlordane Exposure

SOURCE: Bulletin of Environmental Contamination Toxicology, 39:434-442, 1987

In the following study, researchers divided mice into three groups of ten mice each. Two groups were subjected to either a low or higher level of chlordane and the third group was used as a control group not exposed to any chlordane. After 30 days of daily exposure, the animals were sacrificed and the testicles were examined. The researchers stated that the chlordane exposed groups showed obvious changes to the part of the testicles where sperm development occurs (called the seminiferous tubules). Damaged tubules were present in 19% of the lower chlordane exposed animals - 31% of the higher chlordane exposed animals and only 3% in the animals not exposed to chlordane. There was also a reduction in the seminiferous tubule diameter in the higher chlordane exposed group.

Dr. K. J. Balash, M. A. Al-Omar, et al.
Biological Research Center, Scientific Research Council, Baghdad, Iraq

Pet Bladder Cancer Linked to Home Pesticide Use

SOURCE: Journal of Toxicology and Environmental Health; 28 (4). 1989. 407-414

A case-control study of household dogs was conducted to determine if exposure to sidestream cigarette smoke and chemicals in the home, use of topical insecticides, and obesity are associated with the occurrence of bladder cancer. Information was obtained by interview from owners of 59 dogs with transitional-cell carcinoma of the bladder and 71 age- and breed size-matched control dogs with other chronic diseases or neoplasms. Bladder cancer risk was unrelated to sidestream cigarette smoke and household chemical exposures. Risk was significantly increased by topical insecticide use. When dogs were given 1-2 topical pesticide applications per year, there was a 60% increased risk of bladder cancer. When animals were given more than 2 pesticide applications per year there was a 3.5 times increased risk for the animal developing bladder cancer (chitrend; $p = .008$). This risk was enhanced in overweight or obese dogs. Further studies of this canine model may facilitate identification of specific carcinogens present in insecticides commonly used on pet animals and in the environment.

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Pet Bladder Cancer Linked to Lawn Pesticide Applications

SOURCE: Journal of the American Veterinary Medicine Association, April 15, 2004.
Below is a summary from Reuters News (April 24, 2004)

A study that links lawn chemicals to bladder cancer in Scottish terriers could help shed light on whether they cause cancer in some people, U.S. researchers said on Tuesday.

Purdue University researchers surveyed 83 owners of Scottish terriers whose pets had recently been diagnosed with bladder cancer for their report, published in the Journal of the American Veterinary Medicine Association.

"The risk ... was found to be between four and seven times more likely in exposed animals," said Larry Glickman, professor of epidemiology and environmental medicine in Purdue's School of Veterinary Medicine.

"While we hope to determine which of the many chemicals in lawn treatments are responsible, we also hope the similarity between human and dog genomes will allow us to find the genetic predisposition toward this form of cancer found in both Scotties and certain people."

Glickman and his colleagues earlier found that Scotties are about 20 times more likely to develop bladder cancer than other breeds.

"These dogs are more sensitive to some factors in their environment," Glickman said in a statement. "As pets tend to spend a fair amount of time in contact with plants treated with herbicides and insecticides, we decided to find out whether lawn chemicals were having any effect on cancer frequency."

The National Cancer Institute says about 38,000 men and 15,000 women are diagnosed with bladder cancer each year. Humans and animals often share genes that can predispose them to cancer.

"If such a gene exists in dogs, it's likely that it exists in a similar location in the human genome," Glickman said. "Finding the dog gene could save years in the search for it in humans and could also help us determine which kids need to stay away from lawn chemicals."

Glickman's team plans to survey children, as well as dogs, in households that have treated lawns and compare the chemicals in their urine samples with those from households with untreated lawns.

"It's important to find out which lawn chemicals are being taken up by both children and animals," he said.