Project Discovery

My long-term passion for Veterinary Medicine helped me decide to integrate this interest with my enjoyment in math by collecting data from a survey (link to Vet Survey Letter) I planned to give Veterinarians. My original project goal was to see if pets could be an indicator of the health of the environment. I would determine this by looking for a correlation between toxic substances in local surface water and the frequency of feline cancer seen by veterinarians in that area. The survey would ask veterinarians for the number of animal diseases, specifically cat cancer, that has occurred each year in the past 10 - 20 years. I chose cats specifically because they are a popular domesticated animal that, if allowed outdoors, would not be limited to the enclosed yard and would interact with the surrounding ecosystem.

My original prediction was if cats are a good indicator to the health of the environment, then when local veterinary clinics are surveyed on their records on cancer cases in cats, the statistics will prove that where there are large amounts of toxins in the water, there will be many cases of cancer in cats. After contacting numerous government and veterinarian agencies (link to Gov and Vet Agencies), I found out veterinarians are not required by law to record and submit any epidemiological records.

My project has made a shift and now focuses on why veterinarians and public health agencies maintain only limited epidemiological records on the incidence of certain animal diseases when this information could be used to prevent disease in humans. By evaluating the data gathered, if there was such a law, the state could see the impact of an environmental hazard more immediately in outdoor pets than humans. This could be used to control the hazard before many humans become diseased.

. . . the number of children and grandchildren with cancer in their bones, with leukemia in their blood, or with poison in their lungs might seem statistically small to some, in comparison with natural health hazards, but this is not a natural health hazard--and it is not a statistical issue. The loss of even one human life, or the malformation of even one baby--who may be born long after we are gone--should be of concern to us all. Our children and grandchildren are not merely statistics toward which we can be indifferent.

-- President Kennedy, June, 1963

Current California Law

Under current California law, veterinarians are required to report any animal that is diagnosed with or has been in contact with rabies (link to http://www.leginfo.ca.gov/cgi-bin/displaycode?section=hsc&group=121001122000&file=121575-121710), any birds with psittacosis (link to http://www.leginfo.ca.gov/cgi-bin/displaycode? section=hsc&group=121001-122000&file=121745-121765) or any other diseases transmissible to man from pet birds, or any animal that has any of the conditions specified in the "List of Reportable Conditions for Animals and Animal Products." (link to Diseases to be reported) These laws protect humans from diseases transmissible to them from animals. There is no law that includes the reporting of animal diseases caused by environmental hazards. “If the disease is not a human risk factor or can be transmitted to a human, then the records are either thrown away or not gathered at all,” said Dr. Crow, a veterinary oncologist from the Sacramento Oncology Center.

After contacting the California Veterinary Medical Board about which specific diseases veterinarians are required to report, I was forwarded a letter (link to VMAletter) that was sent to veterinary clinics in October of 2001 from the California Department of Food and Agriculture and the California Department of Health Services. This letter was sent to the veterinary medical community “to provide information and encourage reporting of unusual diseases in animals” in this time where the threat of bioterrorism is high. The letter also states that the veterinarians’ “assistance in enhancing veterinary disease surveillance... is requested,” which also helps to prove the lack of any law requiring epidemiological records to be kept by veterinarians.

The Physiological Link Between Humans and Animals

Animal Testing

The scientific community has proven that animals such as mice, cats, and dogs have a very similar genetic makeup to humans. Animal testing would not be as abundant if the physiological effects were not similar between animals and humans. As we see today, it is so common that the terms “lab rat” and “guinea pig” have strong connotative meanings. Mario Capecchi with the Human Genome Project (linked on Mr. Thiel’s AP Biology Resource Page) (link to Mr. Thiel’s page) created an animation (link to http://www.dnaftb.org/dnaftb/41/animation/animation.html) that estimates mice as having 99% of the same genes as humans.

The history of animal testing began as the science of toxicology began grow in the 1870s. With this grew the need to discover the biological causes of new chemicals and substances. Animals were then used in pharmacology laboratories to seek a better understanding of different drugs and their dosages. After the First World War, scientists compared the effects of mustard gas in rabbits’ eyes to the effects seen in soldiers. After the government passed the Food, Drug and Cosmetic Act of 1938, federal regulatory guidelines were required which involved statisticians and numerous testing procedures. (Fano, 11-13)

This link can also be seen in the discoveries and tests with industrial chemicals on animals reported by Discover Magazine’s “Hormone Hell” (link to Hormone Hell page) article in 1996. Some pesticides and by-products from paper and plastics are recently being recognized as endocrine-disrupting chemicals. These chemicals persist in the food chain because they tend to lodge in the fat of animals on the bottom of the food chain which leads to a higher concentration in the animals at the top. “Beluga whales in the St. Lawrence River have PCB levels so high they must be treated as hazardous waste when they die.” These effects are also showing up in newborns whose mothers have eaten contaminated fish from Lake Michigan and tests show they have neurobehavioral problems. (Dold, 58) The extreme problems seen in animals as a result of these harsh chemicals led to the investigation on the effects of humans.

Environmental Hazards to Humans

The Nuclear Accident in Block 4 of the Chernobyl Nuclear Power Station in Ukraine emitted immense amounts of the reactor core into the biosphere when the explosion occurred on April 26, 1986. The Nuclear Energy Agency (NEA) is a specialized agency within the Organisation for Economic Co-operation and Development (OECD), an intergovernmental organization of industrialized countries, based in Paris, France. The NEA created a report (link to http://www.nea.fr/html/rp/chernobyl/c05a.html) on the Chernobyl accident that concluded the radiation exposure to the public could be the major cause in the increase in thyroid cancer. “It was estimated that the incidence of thyroid cancers in children, defined as those diagnosed between the ages of 0 and 14, might increase by about 5 per cent, and in adults by about 0.9 per cent over the next 30 years.” (www.nea.fr) Table 7 (link to http://www.nea.fr/html/rp/chernobyl/table7.html) shows an incredible increase in childhood thyroid cancer over the years.

The lichen, a mosslike plant, in country close to Ukraine has absorbed much of the radiation from the Chernobyl disaster. The reindeer (link to http://news6.thdo.bbc.co.uk/hi/english/sci/tech/newsid\_41000/41770.stm) in Norway and other neighboring countries survive the winter by eating the lichen from old trees and are at risk from the radiation. The Norwegian Radiation Protection Authority now states the people in Lapland are at risk because the people use reindeer as a source of food as well. This is another example of chemicals sustaining in the food chain.

(insert image of reindeer food chain)

Cancer Clusters

The results of Chernobyl could possibly be grouped into what is called a cancer cluster. A disease cluster is the occurrence of a greater than expected number of cases of a particular disease within a group of people, a geographic area, or a period of time. (National Cancer Institute)

Facts About Cancer

Cancer is the uncontrolled growth and spread of abnormal cells anywhere in the body. However, cancer is not just one disease; it is actually an umbrella term for at least 100 different but related diseases.

Each type of cancer has certain known and/or suspected risk factors associated with it.

Cancer is not caused by injuries, nor is it contagious. It cannot be passed from one person to another like a cold or the flu.

Cancer is almost always caused by a combination of factors that interact in ways that are not yet fully understood.

Carcinogenesis (the process by which normal cells are transformed into cancer cells) involves a series of changes within cells that usually occur over the course of many years. More than 10 years can go by between the beginning of carcinogenesis and the diagnosis of cancer. The long period of time between the first cellular abnormality and the clinical recognition that cancer is present often makes it difficult to pinpoint the cause of the cancer.

Cancer is more likely to occur as people get older; because people are living longer, more cases of cancer can be expected in the future. This may create the impression that cancer is becoming much more common, when an increase in the number of cases of cancer is partly related to the aging of the population.

Almost 15 million new cases of cancer have been diagnosed since 1990. Therefore, it is not unusual for several cases of cancer to occur by chance or coincidence within the same family or neighborhood.

Facts About Cancer Clusters

A suspected cancer cluster is more likely to be a true cluster, rather than a coincidence, if it involves:

A large number of cases of a specific type of cancer, rather than several different types;

A rare type of cancer, rather than common types; or

An increased number of cases of a certain type of cancer in an age group that is not usually affected by that type of cancer. (National Cancer Institute)

Well Known Environmental Disasters

Some events, such as the Chernobyl accident, have been large enough to lead to extensive investigations, national attention, and even books and movies about them.

The Civil Action (link to http://www2.shore.net/~dkennedy/woburn\_mit.html) case was made into a movie starring John Travolta. It was based on a man who investigated chemicals from creeks and wells in Woburn that seemed to be the cause of a 400% increase in childhood leukemia. Cryovac manufacturers used TCE to clean tools and thin paint. Unifirst used PCE as a dry cleaning chemical. (Daniel D. Kennedy)

In Toms River, New Jersey, thousands of drums of toxic waste are being removed and cleaned up by the EPA while thousands more remain in one site. Many cases of childhood leukemia are seen around this dumping site.

The Love Canal in New York is an unfinished canal that Hooker Chemical Company decided to use as a landfill for their chemical by-products. The city of Niagra Falls forced Hooker to sell the undeveloped land and they built a school. Children and animals received chemical burns from playing with dirt in the school yard and their backyards. There also is a high incidence of birth defects, miscarriages, and liver and kidney damage.

The story of Erin Brockovich (link to http://www.lawbuzz.com/famous\_trials/erin\_brockovich/erin\_brockovich\_ch1.htm) is another example of an incident that could have been discovered and controlled before it became a disaster. The PG&E's Gas Compressor Station near Hinkley, CA reported high levels of chrome 6, a known carcinogen, in their waste water ponds. It wasn’t until Erin discovere this issue the many people and animals getting diseases were linked to one source. (Lawbuzz.com)

Most of these incidents began to be recognized similarly to what is happening in San Diego. A concerned mother of a child with leukemia made an informal survey that sparked an investigation (link to http://proquest.umi.com/pqdweb?Did=000000103110995&Fmt=3&Deli=1&Mtd=1&Idx=4&Sid=1&RQT=309) by the regional director of the California Cancer Registry and epidemiology division director at the University of California Irvine College of Medicine There seem to be “an unusually high number of cancers in adults and animals” in the area. Officials said that the “California Cancer Registry does not compile animal cancer figures” to help the research. (Millay)

This all leads up to the question of why don’t public health officials compile animal cancer figures?