

## **Silent Witness - Volume 6, Number 1, 2001**

### **Nonhuman DNA Testing Increases DNA's Power to Identify and Convict Criminals**

by Arianne Day, Staff Attorney

DNA is the building block from which all living things develop. The basic component of all DNA consists of a sugar, a phosphate group, and a base. Bases (either A's, T's, G's, or C's) connected in long chains create the DNA "sequence." This sequence is an organism's unique genetic profile. Variations in this sequence allow forensic DNA analysts to differentiate one person from another. Now, thanks to the work of a handful of researchers, these variations can also differentiate between animals, plants, and viruses.

DNA's consistency throughout all living organisms has allowed researchers to apply forensic profiling techniques developed for human DNA to animal, plant, and viral DNA. Several laboratories across the country are currently developing testing kits and protocols for analyzing nonhuman DNA samples. Some are even performing criminal casework.

#### **Animal DNA Traps Three Murderers and Two Reckless Dog Owners**

Statutes dealing with poaching, animal cruelty and Endangered Species Act violations criminalize the movement, possession, or destruction of animals. Since these crimes feature animals, it may not be surprising that prosecutors charging under these statutes often encounter biological samples from animals -- but that is not the end of the story. Blood and hair from dogs, cats, bears, and other animals may be available for testing in a variety of investigations. In fact, prosecutors in a majority of these cases have used animal DNA evidence to link a human perpetrator to a human victim. The first such case occurred in Canada.

In 1994, the Royal Canadian Mounted Police (RCMP) discovered the body of missing Prince Edward Island resident, Shirley Duguay. Authorities suspected that Duguay's recently paroled ex-husband, Douglas Beamish, was involved. Near Duguay's body, the RCMP found a leather jacket covered in Duguay's blood. Although his friends and family acknowledged that Beamish owned a similar jacket, none would positively identify it.

In addition to blood, investigators pulled two white hairs from the jacket. What they originally believed to be strands of the killer's hair were not hairs at all, but fur -- cat fur. Detectives recalled that Beamish's parents owned a white cat named Snowball and obtained a blood sample. Because no Canadian laboratory performed feline DNA testing at that time, the RCMP sent the samples to the National Cancer Institute's Cat Genome Project in Frederick, Maryland. Dr. Marilyn Menotti-Raymond performed Short Tandem Repeat (STR) testing on DNA extracted from the liquid blood and a partial root from one of the hairs, and obtained a match.<sup>1</sup> Based on this and other evidence, a jury convicted Beamish of second-degree murder and sentenced him to 15 years.

Since this groundbreaking case, several prosecutors in the United States have presented in court forensic DNA evidence derived from animal samples. A Seattle, Washington jury convicted Kenneth Leuluaialii and George Tuilefano of aggravated murder and animal cruelty in connection with the 1996 shooting deaths of Jay Johnson, Raquel Rivera, and their mixed breed dog, Chief. Bloodstains on Tuilefano's pants and on Leuluaialii's jacket matched Chief's genetic profile with a random match probability of 1 in 350 million. Then, in 1999, a Tulsa, Oklahoma jury convicted Chris Ohman and Venessa Alexandria Borja of harboring a vicious animal after

the couple's pit bull, Trek, mauled their 74-year-old neighbor. Canine DNA extracted from saliva samples on the victim's clothing matched Trek's genetic profile. While his owners were appealing an impoundment and destruction order, Trek died of a tumor.

In addition to this animal specific casework, some U.S. laboratories provide forensic DNA typing for a variety of species. The Genetics Section of the National Fish and Wildlife Forensic Laboratory performs DNA testing on biological samples from wild animals. Although the laboratory does not accept domesticated animal cases (like dogs and cats), state and local authorities may avail themselves of its services in prosecutions involving wildlife. For example, Minnesota officials asked the Genetics Section for assistance when they found several wild and protected animals poisoned. DNA testing matched the tainted meat in the animals' stomachs to deer meat that police found in the suspect's freezer.<sup>2</sup>

#### Appellate Court Upholds the Admissibility of Plant DNA Evidence

Humans constantly interact with all aspects of nature -- both flora and fauna. Despite the modern world of concrete and glass, plant life is everywhere. DNA testing of plant materials can provide an investigative lead or evidence of identity, or, in certain cases, prove an essential element of a crime.

At the Connecticut State Police Forensic Science Crime Laboratory, Dr. Heather Miller Coyle is validating a DNA typing system for a particular plant species, the possession and sale of which constitutes a crime -- marijuana. Dr. Coyle, a criminalist with the Forensic biology and DNA Section, is developing species-specific DNA sequences and extraction methods for a marijuana DNA kit. She expects the resulting kit to identify particular plants and to link samples to particular geographic regions.

Once Dr. Coyle brings the casework capabilities online<sup>3</sup> and, for example, matches a defendant's marijuana stash to a large crop growing in an abandoned lot, a prosecutor will likely present this DNA evidence in court. Because of the pioneering work of an Arizona prosecutor, and the resulting appellate decision in *State v. Bogan*, this task will be easier.<sup>4</sup>

The *Bogan* case began on May 3, 1992, when a boy in Phoenix, Arizona found the nude body of a young woman who had been strangled to death. An eyewitness told police that he saw a white pickup truck speeding away from the area the night before. Near the victim's body, police found a pager that led them to Mark Bogan, the owner of a white pickup.

Bogan's version of the evening was as follows. He picked up a female hitchhiker a couple of miles down the road. After they had sex in his truck, Bogan and the woman began to argue. When he ordered her out of the truck, she stole several items from his dashboard, including the pager. He denied killing her or being near the area where police found her body.

Detectives searched Bogan's vehicle and found two seedpods from a Palo Verde tree (Arizona's state tree) in the truck bed. At the crime scene, detectives noticed a clump of Palo Verde trees, one of which showed recent abrasions on the bark. Using DNA testing, a molecular geneticist at the University of Arizona matched the seedpods from Bogan's truck to the crime scene samples. After a *Frye* hearing, the court admitted the plant DNA evidence and the statistical significance of the match, thus placing Bogan's truck at the scene of the crime. The jury convicted him of first-degree murder, and the Court of Appeals upheld that conviction.

#### Viral DNA Evidence Convicts Doctor Who Used HIV as a Weapon

The human Immunodeficiency Virus (HIV), the virus that causes AIDS,<sup>5</sup> has killed more than 18.8 million people worldwide since the epidemic began.<sup>6</sup> Due to the risk of infection during sexual contact, several states have passed legislation criminalizing unsafe behavior by persons infected with HIV and AIDS.<sup>7</sup> Interestingly, the first time a prosecutor presented viral

DNA/RNA evidence in court the case involved not reckless sexual contact by an infected person, but rather the intentional use of the HIV virus as a weapon by an uninfected perpetrator.

From 1984 to 1994, Dr. Richard Schmidt and his nurse, Janice Trahan, carried on an extramarital affair. When Trahan realized that Schmidt would not leave his wife, she ended the relationship. However, they maintained their friendship and working relationship. In fact, Schmidt continued to administer a series of Vitamin B-12 shots to Trahan. One such shot, Trahan would later tell the authorities, was more painful than usual. When her health began to deteriorate shortly thereafter, doctors notified Trahan that she had contracted HIV and Hepatitis.

The state charged Schmidt with attempted second-degree murder for intentionally injecting Trahan with the HIV virus. Researchers at the Baylor College of Medicine in Houston, Texas analyzed the HIV strain in Trahan's blood sample. They also profiled the HIV strain of one of Schmidt's HIV-infected patients. Using phylogenetic comparison techniques, the expert was able to testify that the two strains were "closely related."<sup>8</sup>

On an interlocutory appeal, the Louisiana Court of Appeals affirmed the trial court's decision admitting the viral DNA/RNA evidence under the Daubert standard. A jury convicted Schmidt and sentenced him to 50 years of hard labor. The appellate court upheld his conviction.

Prosecutors and Investigators Should Consider Nonhuman DNA Options

Forensics relies on the theory of transfer. Whenever a person encounters another person, he both leaves something of himself behind and carries something of the other person away. Forensic DNA testing, limited in the past to only human DNA, required that the perpetrator and victim exchange blood, semen, hair, or skin cells. Although such biological evidence often arises in homicide, sexual assault, and burglary cases, it is not always available.

By expanding the scope of forensic DNA testing to include animal, plant, and viral DNA samples, researchers have greatly increased the chance that crime scene investigators will find genetic material that prosecutors can use to link a murderer to the crime scene, a rapist to his victim, or a drug dealer to his crop. Only when prosecutors and investigators broaden their view to include the variety of tests that forensic laboratories now offer can DNA evidence reach its full potential to identify and convict criminals.

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1 If you are interested in submitting a cheek swab from your pure breed cat for the National Feline Forensic Database, please contact Dr. Menotti-Raymond at (301) 846-1299. Telephone Interview, Dr. Marilyn Menott-Raymond, Laboratory for Genomic Diversity, National Cancer Institute, Frederick, Md. (Mar. 4, 2001)

2 Telephone Interview, Dr. Jerry Ruth, Senior Forensic Specialist, National Fish and Wildlife Forensic Laboratory, Genetics Section, Ashland, Ore. (Feb. 28, 2001). The Wyoming Game and Fish Forensic Lab is the only laboratory that performs individualization tests on animals such as mountain lions, antelopes, and pronghorns for state and local prosecutors. Telephone Interview, Debra Hawk, Forensic Specialist, Wyoming Game & Fish Forensic Laboratory, Laramie, Wyo. (Mar. 22, 2001).

3 Telephone Interview, Dr. Heather Miller Coyle, Criminalist, State Police Forensic Science Laboratory, Forensic Biology/DNA Section, Meriden, Conn. (Mar. 8, 2001).

4 905 P.2d 515 (Ariz. Ct. App. 1995).

5 The AIDS virus is a ribonucleic acid (RNA) differing from DNA in three ways: (1) an oxygen molecule; (2) single-stranded, and; (3) uracil instead of thymine. Forensic testing using RNA uses the same basic techniques and theories as DNA.

6 UNAIDS, *Report on the Global HIV/AIDS Epidemic -- June 2000* (visited Mar. 27, 2001) <[http://www.unaids.org/epidemic\\_update/report/glo\\_estim.pdf](http://www.unaids.org/epidemic_update/report/glo_estim.pdf)>.

7 See Ark. Stat. Ann § 5-14-123; Cal. Penal Code § 12022.85; Fla. Stat. § 775.0877; Idaho Code § 39-608; 720 ILCS § 5/12-16.2; K.S.A. § 21-3435; Mo. Rev. Stat. § 191.677; Nev. Rev. Stat. Ann § 201.358; S.C. Code Ann. § 44-29-145; Tenn. Code Ann. § 39-13-109; Wis. Stat. § 939.622.

8 Because the HIV virus mutates after infecting a new host, analysts cannot directly compare HIV DNA samples from two different people. Phylogenetic analysis allows the analyst to determine the degree to which two viral DNA strains are related to each other. *State v. Schmidt*, 699 So. 2d 448, 452 (La. Ct. App. 1997).