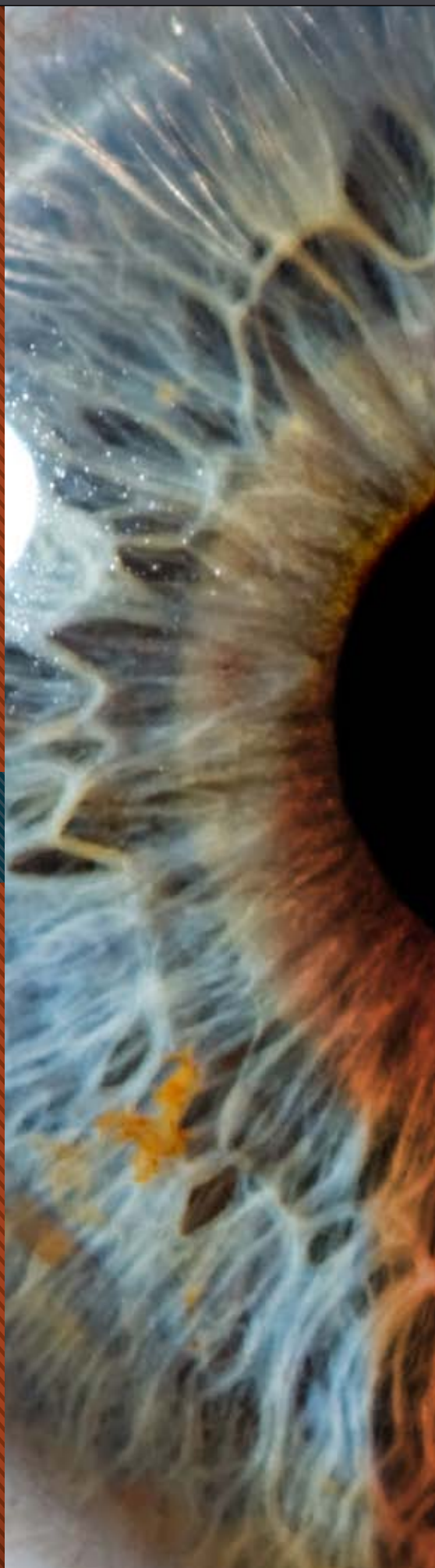
VISION SCIENCE IDENTIFICATION OVERVIEW:

OCULAR DETAIL AND OPHTHALMIC APPLIANCES AS POTENTIAL AID IN FORENSIC IDENTIFICATION



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ABSTRACT

Ophthalmic appliances have been utilized in forensic identification. Additionally, ocular features may be of assistance in identification for live missing individuals and pre-decomposed deceased individuals. This paper discusses some ocular features and ophthalmic appliances potentially useful in identification. Venues of distribution regarding placement of potential identification features are also discussed (Iris biometrics has been discussed in a prior article and will not be addressed in this writing).

INTRODUCTION

A young girl is missing while vacationing in a foreign country. What are you going to put out to the public to help locate her? What will make her standout from the rest of the population? Her age? Her gender (What if the individual is disguised by dressing in the opposite gender)? The color of her hair (hair could be colored differently)? Her height? One feature that is difficult to obscure is the eyes.

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AFTER STUDYING THIS ARTICLE, PARTICIPANTS SHOULD BE BETTER ABLE TO DO THE FOLLOWING:

1. List ophthalmic appliances which may aid in identification
2. Compute rarity of ophthalmic prescriptions
3. Analyze information for potential items or features useful in ocular and ophthalmic aids in the identification process
4. Discuss current applications of ophthalmic appliances and ocular features
5. Discuss how professions may use imaging retrieval of ophthalmic prescription information and its usefulness.

KEYWORDS: ophthalmic prescription, vision science, forensic identification, contact lens, ocular features
TARGET AUDIENCE: Those involved in forensic identification, forensic anthropology
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FINANCIAL DISCLOSURE: none

OCULAR FEATURES

Potential identification, whether in locating a live individual or connecting with a John/Jane Doe, may be aided with ocular features and/or ophthalmic appliances. Ocular features may be divided into categories of detection by casual observation or, more likely, detection by inspection performed by a health care provider. Iridotomy, iridectomy, artificial iris, corneal scars, radial keratotomy, LASIK, corneal graft, cataract surgery, and permanent eye liner are details which are revealed under magnification and examination conditions, therefore more likely to be detected by an eye care professional. Features more likely to be detected by casual observation include: heterochromia, sector heterochromia, iris coloboma, and others.

HETEROCHROMIA

A difference in coloration, usually of the iris but also of hair or skin. Heterochromia is a result of the relative excess or lack of melanin (a pigment). It may be inherited, or caused by genetic mosaicism, disease, or injury.

The Madeleine McCann case is an example of capitalizing upon an ocular unique feature, which is apparent under casual observation. Madeleine exhibits sector heterochromia, where an increase of pigment occurs on one area of the iris and is not regularly distributed. Photographic images along with a graphic have been designed to further draw attention to her unique iris pigmentation.

More recently, a police agency from one of the New England states was seeking identification and location of a young girl. The case was being treated as a missing person's case and involved criminal international internet child abuse. A blue iris/green iris heterochromia was the unique ocular feature utilized to help identify and locate the girl, along with information about her spectacle frame.

The photographs were appropriately published in a nationally distributed optometric magazine in the hopes that an eye care professional may have encountered the child at an eye examination. The details of the case are not presently available; however, the strategy was successful.

Some ocular features are not apparent under macro inspection. These include cataract surgery and refractive surgery. Such features/surgeries are observable during a thorough biomicroscopic examination.

If an ocular feature is thought to be of use in identification, it is the author's opinion(s) to have an optometrist or ophthalmologist review the eye features/appliances from the examination records or available photographs, and make suggestions in determining what details and what audience best disseminate the potential identifying information. These questions should be answered: Would the feature be more readily observed in an examination, therefore disseminate the pertinent information in optometry and ophthalmology publications? Is the feature readily observed, and the information made available for the general public? Is the feature observable by both audiences?

OPTOSEARCH AND JPAC

The Joint POW/MIA Accounting Command (JPAC) and its Central Identification Laboratory (CIL) are charged with the mission to achieve the fullest possible accounting of all Americans missing as a result of the nation's past conflicts. The JPAC is composed of approximately 475 personnel of whom the majority are uniformed military members, and is directed by a two star general. The CIL has specialized civilian staff, composed of advanced degree-holding anthropologists (around 35 MA and PhDs) and three professional forensic dentists. In pursuit of the mission, the JPAC fields approximately 70-80 recovery teams each year across the globe, excavating and recovering missing US service personnel from countries such as Vietnam, Laos, South Korea, Papua New Guinea, Germany, France, etc. There are very few places JPAC teams have not been deployed, and some of the most unusual recoveries have been in Greenland, North Korea, and the mountain heights of Tibet and Irian Jaya. Site types range from WWII bomber crash sites where most of the plane is still intact to isolated grave sites in the middle of a jungle (Figure Xa).

At the current time, the total number of missing US service personnel is approximately 200 for the Cold War, 1,800 for the Vietnam War, 8,000 for the Korean War, and 78,000 for WWII (these numbers are approximate and depending on the source, may vary significantly, particularly for WWII).

JPAC excavation teams typically are composed of 11 military members and are led by a civilian anthropologist. The average deploy-

FIGURE XA. Aerial view of a Vietnam era aircraft crash site in Laos. Note different excavation techniques used (steps) due to steepness of the slope. Active excavation is in the center of the photograph, screening stations are to the sides of the excavation. **FIGURE XB.** Dry screening sediments in Palau, while working on an American WWII aircraft crash site.

ment is between 35 and 60 days, and the excavation of any given site may take from three or four days to over 100 days. Frequently, the excavation teams dig approximately 500 square meters at a site per mission, using archaeological techniques and processing all of the site sediments through ¼ in. mesh screens (Figure Xb).

Local nationals are employed to help excavate the sites; a large site may employ 200 local nationals, while smaller sites may only utilize 5-10 individuals. The excavation is documented through standard archaeological practices such as daily notes, photographs, line drawings, and section profiles. These efforts are undertaken to ensure that each site is processed in a scientifically sound manner, and all material evidence and human remains are documented in accordance to evidentiary standards.

The recovered material evidence and human remains from a site are transported back to the CIL in Hawaii for identification. Once there, the remains and evidence are subjected to multiple analytical tests in order to produce a scientifically accurate identification of a missing person. Multiple lines of evidence are used in this process and include but are not limited to: dental analysis via comparisons using antemortem and postmortem x-rays and charting, anthropological analysis that details the biological profile (age, sex, race, stature, trauma, and personally identifying features of the remains), material evidence analysis that examines all significant personal effects or military gear, mitochondrial DNA, and nuclear DNA analysis. The CIL does not undertake its own DNA analyses; rather those specialty analyses are conducted by the Armed Forces DNA Identification Laboratory (AFDIL). Once the totality of the evidence is assembled and it is judged to be accurate and without question, the Scientific Director of the CIL makes the identification of the remains.

The identification process can be lengthy, as each specialty or analysis takes many manhours. Compounding the normal problems surrounding analytical time, cases that are heavily commingled (the human remains are mixed together due to crash dynamics, looting, or intentional burial) take even longer, as efforts are made to segregate out each individual and identify any personal belongings that may be associated with him/her. The quickest identification made by the CIL was approximately three days, though the typical case takes upwards of two or more years. In some instances, cases that were received in the early 1990s are now being completed; the advancement of the science over the last two decades in human genetics, anthropology, and artifact analysis has allowed for previously unidentifiable remains to now be identified and returned to their families.

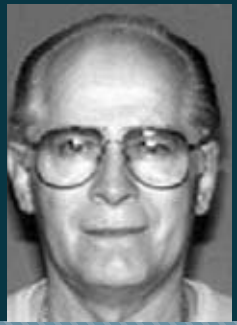
OPHTHALMIC APPLIANCES

Numerous examples of utilizing prescription eyewear in forensic identification exist. The earliest found was the connection between a murderer's unique spectacles discovered at the scene of a murder victim: the 1924 murder of Bobby Franks by Leopold and Loeb.

A more recent example involving ophthalmic eyewear includes a Connecticut eye doctor who was subpoenaed to testify that a robbery suspect did in fact have spectacles prescribed. The suspect was seen on videotape wearing spectacles during the crime, yet the suspect claimed it was not him since he did not have spectacles.

Dr. Forkiotis, a Connecticut State Police surgeon, was commonly asked to retrieve spectacle lens powers from lens fragments in order to determine if the findings were consistent with the spectacle prescription of the victim or the alleged offender. *Review of Optometry* featured information on a Jane Doe's (UFMA 187) prescription eyewear hoping that a practitioner might match the prescription and the spectacle frame specifications to a patient in their database.

The FBI Top Ten Most Wanted "Whitey" Bulger's image was also featured in *Review of Optometry* in hopes of locating the fugitive. He sports a rather strong powered pair of spectacles.



Whitey Bulger

CE ARTICLE

Members from the Joint POW/MIA Accounting Command working at remote excavation sites in the Xepon Province, Lao People's Democratic Republic, in the Fall of 2009. The JPAC mission is to achieve the fullest possible accounting of all Americans missing as a result of our nation's past conflicts. (JPAC photo's by U.S. Air Force Staff Sgt. Jesse M. Shipps and U.S. Marine Corps Sgt. Rebekah M. Ide.)

"UNTIL THEY ARE HOME"

Secondary to this mission, the JPAC-CIL participates in humanitarian missions around the world in instances of need when our particular specialties are useful (typically in instances of personal identification/recovery/mass disasters). Anthropologists from the JPAC-CIL have participated in recovery and identifications from 9/11 (Pentagon), Korean Air Lines Flight 801, the 2005 Thailand Tsunami, and, more recently, Agni Air Flight 101 in Tibet. Along with these duties, JPAC anthropologists and odontologists are frequently asked to participate in local and national forensic identification cases for police departments, medical examiners, and court officials.

The increasing demand for scientific accuracy and new methods in anthropology and artifact analysis joined again in 2005. An anthropologist from the CIL posed a (supposed) series of simple questions to a military ophthalmologist. The first question of "does this prescription match the antemortem record for this individual?" was answered with a simple "yes." A follow-up question was asked, for which there was no clear answer. That question, "how strong of a match is it (is the prescription unique, rare, or common)?" led to a joint effort between the anthropologist and the ophthalmologist to quantify the strength of the match between an ophthalmic device prescription and antemortem records for use in court cases and personal identification. This is particularly important in the forensic community, as scientific results need to have known error and accuracy rates, among other issues (*vis-à-vis* the Daubert ruling). The answer to the second question was found simply by using a statistical approach to eyeglass prescription strengths and their frequencies in modern populations.

The resulting findings were published in a few peer-reviewed journals (Berg and Collins 2007, Collins and Berg 2008) and now are available for use in an online tool. This web-based tool, OptoSearch, allows for investigators to calculate the rarity of a prescription using multiple databases that have a combined total of over 380,000 prescriptions. It is therefore an excellent representation of the rarity of prescription data in the U.S. and likely the world. This

The ultimate goal of the Joint POW/MIA Accounting Command, and of the agencies involved in returning America's heroes home, is to conduct global search, recovery, and laboratory operations in order to support the Department of Defense's personnel accounting efforts.

tool can be found at: **http://bit.ly/cxbZwX.** It can also be reached using a simple web search, keyword OptoSearch. A detailed set of instructions is provided in the publications that are listed on the website. In short, a detective, an investigator, an ophthalmologist, optometrist, or just about anyone with knowledge of eyeglass strengths can use this tool to calculate the frequency of a given prescription, and thus determine if it is common, rare, or unique. It can be directly applied to identification cases (or criminal cases) to show the credibility of a conclusion regarding the strength of a match between antemortem records and eyeglasses presented as evidence. A short military case example using this tool and the rarity of the prescription will be described below, followed by its application in a civilian murder trial.

In 1967, a U.S. military F-105 pilot crashed while on an armed reconnaissance mission over Southeast Asia. The pilot was declared MIA, and his remains were not recovered. In 1993 and 1997, JPAC-CIL investigative teams went to Lao People's Democratic Republic to investigate the loss incident. Through the interview process, it was discovered that local witnesses believed that the pilot's body was buried near the aircraft crash site. In 2002 and 2003, JPAC-CIL excavation teams dug the purported burial site and recovered skeletonized remains, as well as portions of an anti-gravity flight suit, pilot-related equipment, and several sunglass lens fragments (Figure Xc).

The remains and material evidence was repatriated to the JPAC-CIL immediately following the recovery mission.

The four fragments of sunglass lens were analyzed using a three point laser lensometer, the Humphrey® 350 Lens Analyzer, and two yielded a readable prescription of: sphere = -0.50, cylinder = -0.25, axis = unreadable. These fragments exactly matched the left eye prescription of the missing pilot, an eye exam that was dated approximately one year before he went missing. The left eye prescription was compared against the database provided in OptoSearch and returned an exact match frequency of 0.66, or less than 1% of all prescriptions for a left eye. The pilot's complete eye prescription is unique in the database, generating a frequency of 2.66×10^{-6}. The strength of match frequencies indicate that another individual having the exact same left eye prescription (not including axis) is approximately six in one thousand, and a minimum estimated frequency for an exact match to both eyes is approximately two in one hundred thousand. While these frequencies are extremely strong, additional work can be done with this case using other lines of evidence.

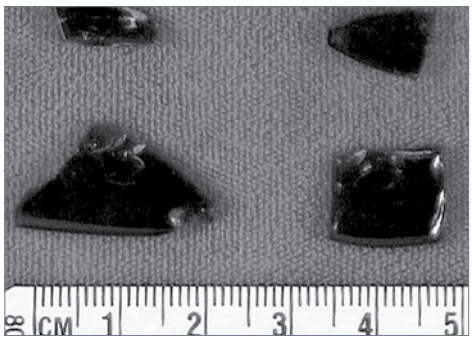


Figure Xc. Sunglass fragments recovered from the crash site. Note the small size of the lens pieces, yet they still yielded viable prescription data.

If two different pieces of data are independent of each other, then their probability inferences (frequencies) can be combined via the product rule via a straight multiplication of their frequencies. Leney and Adams (2004) have applied the product rule in cases with mitochondrial DNA and odontological patterns, with the assumption that the data sets are independent. Optical frequencies are similar to odontological patterns of extraction and restoration. They each have a genetic basis, but are likely affected by disease patterns, environment, trauma, etc. Genetic coding for dental states and the subsequent treatment of the dentition should be independent of underlying genetic coding for eye conditions and the treatment of those refractive errors. If both of these data sets are used together, the probabilities for identification dramatically increase.

The dental charting for the pilot was input into a dental search program called Odontosearch (which is also available on the JPAC website). The dental pattern frequency, using a generic search in all databases, yielded a frequency of 2.49×10^{-5}. The frequency indicates that the exact dental pattern is found in only two out of ten thousand persons. Being conservative, the frequency found for the left eye prescription was used here (0.66). Employing the product rule, the dental and optical frequencies were multiplied together to determine the chance that an individual selected from the population at random would have the exact same dental pattern and matching refractive error. Together, the frequency is 1.64×10^{-7}, or worded slightly differently, approximately three per one million persons are estimated to have the same dental pattern and optical correction by chance alone. This is extremely strong evidence for the identification of the pilot, just based on the dental and ophthalmic patterns, let alone any other evidence such as the biological profile from anthropology, mtDNA or nuclear DNA analysis, the correct aircraft, any personal identification media, and so forth.

WATANABE MURDER CASE, HAWAII

A second example illustrates the use of ophthalmic corrections in the judicial system. On April 12, 2007, a 21year-old Japanese visitor to Hawaii went missing while walking along Pupukea Road on the North Shore of Oahu. The inhumanity of her story, and that of her now convicted killer, is difficult to comprehend. Ms. Watanabe was the youngest of five siblings (all older brothers), very socially withdrawn, and highly dependent on her mother. She rarely looked people in the eye, and rarely spoke to people outside of her immediate family. Due to these difficulties, her family devised a strategy to bring her out of her shell that entailed multiple trips to a relative's house on Oahu lasting for several months in hopes that she would establish more self-reliance and become more social. On her final trip, Ms. Watanabe developed a daily regimen of being up early, cleaning the house, and then departing for Sunset Elementary School where she volunteered during the morning shift. When she was finished, a school employee or friend would drive her to the base of the hill where she lived and she would walk up the hill (Pupukea Road) for exercise. All of this was typically completed by 10 am each day. When she had not returned by 10 am on April 12th, her caretaker went looking for her, and reported her missing to Honolulu Police Department (HPD) at 11:42 am.

The missing persons report triggered a series of actions and reactions by the HPD, including canvassing the area, interviewing citizens, Crimestoppers and other media alerts, and an area search with other departments (medical, fire). Over the course of several days, citizens reported seeing a Japanese girl on the morning of April 12th walking along Pupukea Road. One individual reported seeing her talking to an individual in a Hauoli Pest Control truck and indicated that she eventually entered the truck. A tip, but on a completely separate matter, was reported to HPD by phone—a man was seen digging a hole by flashlight at the Kahana Bay Fishpond near midnight on the 12th of April. The man was using a new shovel and gloves, and when approached, gave his name as "Matt Ford." The man soon fled the scene and the witness had the clarity of mind to scratch the license plate number into the road stripping with a rock. This report led to a follow-up on the plate number; it was licensed to a Hauoli Pest Control fleet vehicle driven by Kirk Mathew Lankford. Police subsequently interviewed Mr. Lankford on Saturday, April 14th, where he denied all knowledge of Ms.

CONTACT LENSES

Contact lenses are typically worn in lieu of spectacles, or worn for cosmetic purposes as enhancing or changing apparent eye color. Tinted and colored contact lenses may give the observer the impression that the wearer's eye color is different than the natural hue. In that case, using eye color as an aid in identification may be counterproductive.

COLORED CONTACT VS NATURAL IRIS

Regarding live identification, some colored contact lenses may obscure iris detail and interfere with iris biometric scans (ref-author's experience). Contact lenses may be found on an unidentified corpse or at a crime scene. They may be buried in soil for years and typically will not deteriorate (author's experience with contacts buried 7 years retain power parameters).

Experienced eye care practitioners may retrieve prescription information. Power, type, manufacturer, specialty such as toric designs for astigmatism, soft material, rigid material, diameter, base curve(s), color, and any other information should be measured and recorded.

Contact lens identification

Watanabe, or having ever seen her. During an interview on the following Monday, HPD secured both Mr. Lankford's private truck, as well as the Hauoli Pest Control truck for searches, only to find a new windshield installed on the pest control truck on April 12th due to a reported "bird strike." A luminol search of the pest control truck showed bloodstains on the passenger side seat and door. In addition, a pair of silver wire-rimmed glasses was found in the truck. The glasses, as well as antemortem prescriptions for Ms. Watanabe, were sent to the CIL for analysis.

The glasses were initially analyzed to determine prescription strength by an optometry technician at the 15th Airwing Optometry Clinic on Hickam Airforce. The resulting prescription data, R eye -5.50 x -3.50 x 178, L eye -4.25 x -2 x 180, was within ANSI standards of being a match to antemortem prescription data for Ms. Watanabe. Using the aforementioned strength of match tool, the prescription was determined to be unique, and was calculated to have an estimated frequency of 2.57×10^{-6} or 0.0003% in the population at large. In other words, 2.5 people out of one million might have a similar prescription. Given the fact that Oahu has a population fewer than one million individuals, the likelihood of another individual having this prescription was nearly zero. The match of the eyeglasses placed Ms. Watanabe in or near Mr. Lankford's pest control truck. On the strength of this evidence, in conjunction with the luminol test for blood staining, Mr. Lankford was placed under arrest, and the investigation was continued in earnest.

Other evidence recovered by HPD included a GPS unit in the Hauoli Pest Control truck. The unit showed several "unscheduled" stops occurred on April 12th outside of the normal work calls. One of these stops was shown to be at a Foodland near Pupukea Road, where Hefty bags, Clorox spray, paper towels, and a can of "Full Throttle Fury" energy drink were purchased at 11:20 am. Evidence from Mr. Lankford's personal truck included the packaging for a pair of work gloves purchased from a local Home Depot store. The gloves were purchased on April 12th at 10:15 pm, along with a shovel, more Hefty bags, duct tape, and a flashlight with batteries.

Over the course of the next 10 months, police searched for the body of Ms. Watanabe, now believed to be deceased. At least three areas on Oahu were rigorously searched with the aid of professional anthropologists from the CIL while police and local volunteers investigated numerous other areas. Her body was never found, nor was any additional evidence of a burial location unearthed. The blood evidence in the Hauoli Pest Control truck was eventually found to match Ms. Watanabe, with the likelihood of it matching another individual being approximately 1:304 trillion. Prosecutors brought Mr. Lankford to trial on second-degree murder charges without a body in February 2008. On April 15, 2008, Kirk Lankford was found guilty of second-degree murder; his defense was that in fear of losing his job, he disposed of Ms. Watanabe's body in the ocean after she died in a freak accident involving his pest control truck. He claimed to have accidentally hit her and was driving her home when she became agitated and leapt from the moving truck, striking her head on a large boulder on the side of the road, killing her. The jury rejected his claim and found him guilty of second-degree murder with the possibility of parole. In August 2008, the parole board determined his minimum sentence to be 150 years before being eligible for parole. Mr. Lankford is currently moving through the appeals process while incarcerated.

TECHNICAL NOTES, OPHTHALMIC APPLIANCES, AND OCULAR FEATURES

Spectacle frame information and lens prescriptions may be retrieved from eye doctors' examination/spectacle order records. Conversely, spectacle frames have retrievable information such as the temple size, eyewear size, bridge size, frame color, manufacturer, and model.

The lens prescription may be retrieved using an instrument commonly called a lensmeter, vertexometer, or lensometer. These may be manually operated or automated.

An experienced eye care provider should be utilized in measuring these parameters. By convention, the right lens is measured first (a lens fragment may be sufficient in measuring lens power). The spherical powers, astigmatic powers, and axis or position of the astigmatism power and bifocal/multifocal powers are all noted if applicable. The optical centers of the lenses are determined on each lens and the pupillary distance is measured as the distance between the centers. Bifocal heights are also measured. The type of bifocal or multifocal are noted if applicable, and any other lens features or coatings/tints are noted. These include photochromic lenses (change darkness depending upon illumination), tints such as solid, gradient, mirrored, polarized, etc. Surface treatments such as anti-reflective coating and ultraviolet filter should be noted.

Automated Lensometer

Frame manufactuer, color, temple size

Eyewire/Bridge size

Spectacles are typically worn most moments while awake. Lens material should be determined such as glass, plastic, and type of plastic if possible. Glass lenses should be tested with a polarimeter to determine if they were heat tempered. Edge treatment should be noted: grooved, polished, safety bevel. They are exposed to the environment the wearer experiences. Sometimes debris on the lenses, fingerprints, or wearer's cells may be found. Glass lenses may have pits if the wearer was in the presence of grinding sparks. An experienced eye care practitioner will typically recognize the fore-mentioned aspects.

OCULAR PROSTHESIS

Ophthalmic appliances (eyeglass frames, eyeglass lenses, contact lenses, Intra Ocular Lenses, iris implants, corneal implants, ocular prosthetics etc.) might remain years after body decomposition. A careful inspection of the remains and surrounding site is necessary to discover the items or their fragments.

OTHER OPHTHALMIC APPLIANCES

Individuals may employ ocular prosthetics, intraocular lens implants, or iris implants. Custom ocular prosthetics are typically made to match the existing eye, or matched from a photograph if both natural eyes are in need of replacement. Stock prosthetics are not made specifically to the individual as custom prosthetics are, yet both require professional fitting and matching, typically by an ocularist or specially trained eye care practitioner. Iris prosthetics may be removed for routine cleaning.

Intra Ocular Implants are used to replace the natural lens removed surgically when cataracts impair vision. There are many IOL designs. These are typically found in older individuals, but younger patients can have IOLs with early cataract formation or in a type of refractive surgery termed clear lens implant.

Iris implants are allowed by compassionate use by the Food and Drug Administration where the natural iris is missing (aniridia) or damaged. These may be fashioned to match the existing iris and may be textured or have a flat surface. The devices are surgically implanted in the eye. Currently, two iris prosthetics are implanted in the United States.

Healthcare providers are allowed through the Health Insurance Portability Privacy Act (HIPPA) to aid law enforcement in investigations of crime and protection of victims.

OCULAR FEATURE LIST, A SAMPLING OF SOME OCULAR FEATURES OF INTEREST
Eye color **
Heterochromia **
Sector Heterochromia **
Ocular prosthetic*
Iris implant *
Intra ocular implant and type*
Refractive surgery and type*
Aniridia**
Anisocoria
Iridotomy/ iridectomy*
Corneal graft*
Corneal scars*
Iris nevus(i)*
Pterygium
Permanent make-up/eyeliner
** denotes more likely detected via professional observation. **May be obscured by cosmetic or colored contacts*

SPECTACLE FRAME INFORMATION
Bridge size
Eyewire size
Temple size
Color
Manufacturer

SPECTACLE LENS INFORMATION
Lens power: sphere, astigmatism, axis, bifocal/ multifocal add, prism
Pupillary distance
Material
Coatings
Ultraviolet protection
Tint
Photochromic
Special purpose: vocational, golfing, shooting, industrial safety
** requires professionally operated ophthalmic equipment*

CONTACT LENSES
Rigid or soft
Powers
Base curve if retrievable
Diameter
Specialty, bifocal, astigmatic, colored, tinted, special cosmetic
**requires professionally operated ophthalmic equipment*

IMPLANTABLE DEVICES
Intra ocular lenses
Iris implant
Corneal implant
**Professional observation*

CE ARTICLE

EXAMPLE SEEKING AID IN IDENTIFICATION

The following is an example of seeking aid from the professional eye care community in a currently unsolved pair of related murder cases. This was disseminated by professional e-mail list-serves across North America and in states involving the likely geographical areas.

Dear Colleagues,

In 1995, Massachusetts State Police Detectives canvassed North East optical establishments including my optometric office. They were attempting to match prescription eyewear of Jane Doe 187UFMA found in Tolland, Massachusetts, near the Connecticut border. The spectacle information and the prescription were retrieved. The investigators asked to have us manually sift through our records to find someone with that particular prescription/ spectacle combination--back then most records were on paper, and not computerized. The information was also sent out to *Review of Optometry* over the years, without any response.

Prescription eyewear has been used in forensic identification in many cases. Apparently the earliest example was in 1920 in the murder investigation of Bobby Franks. Prescription eyewear is currently utilized by the Joint Prisoner of War/ Missing in Action Accounting Command (JPAC) in tentative identification of our lost War Dead.

JANE DOE 187 UFMA, SPECTACLES

On October 6, 1995, a camper filling his trailer with drinking water found the partially decomposed Jane Doe 187UFMA in Tolland State Forest, Massachusetts. Authorities believe she was killed in the vicinity of *a station where campers dispose of trash and sewage. No sleeping gear was found with the victim.*

ESTIMATED DATE OF DEATH:
4-8 days prior

CAUSE OF DEATH:
homicide

ESTIMATED AGE:
30-45 years old

APPROXIMATE HEIGHT AND WEIGHT:
5'2-5'4"; 120-140 lbs

DISTINGUISHING CHARACTERISTICS:
She is a light-skinned female of unknown race. Possibly Black or Hispanic, or perhaps of the Native American community. Brown hair with some graying. Medium build.

DENTALS:
X-Rays available. Upper and lower bridge work with only a few of her own natural teeth left. The dentures appear to be inexpensively made.

DNA:
Available: nucDNA at Massachusetts Police Forensics & Technology Center and mtDNA at New Jersey State Police Office of Forensic Sciences.

FINGERPRINTS:
Available, although no matches in the FBI database.

EYEGLASSES
with a prescription of –4.25 –0.50 x 180 O.D., –3.50 –0.25 x 170, in size 52/16-135 maroon/gold frames from the Metaline Collection (#7) line from Value Eyewear Inc., of Clifton, N.J., manufactured in China.

CLOTHING:
She was wearing the clothes that appear in the pictures below. A unique drawstring hooded sweatshirt with the word Trends in a diamond on the left chest (sold in & around upstate NY). The sweatshirt also had a red and black Aztec print on the hood, sleeves, and pouch pockets. Bill Blass pleated jeans size 8, size 40B bra, a maroon, long-sleeved, Sarah Morgan velour shirt and navy blue Passport shoes with gold studs (size 7 1/2).

JEWELRY:
She was wearing several silver rings, a plastic ring on her left index finger and a metal ring on her right index finger, dangling silver earrings, and had a gold watch with a black face on her left wrist. She was not wearing socks and her toenails were painted red.

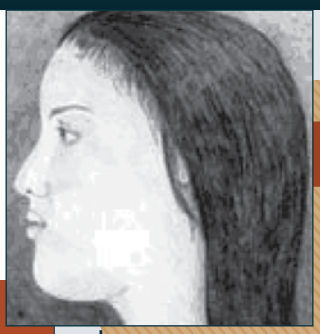
She was wearing a style of sweatshirt that was only sold in three stores in this part of the country: all three of those stores were in the Capital (Albany) Region. The sweatshirt could only have been purchased in 1994 at a now defunct store called The Stockroom. The Stockroom had locations at either the Rotterdam Square Mall, Wilton Mall, or the Northway Mall. The victim also had a pack of Carlton cigarettes that had a New York state tax stamp. The stamp itself was used by a company in Latham, which distributed cigarettes throughout the Capital Region.

CE ARTICLE

YOU MAY BE INSTRUMENTAL IN IDENTIFYING TWO UN-IDENTIFED MURDER VICTIMS WITH FORENSIC VISION SCIENCE

More recently, investigators have linked another Jane Doe (175UFCT) to Jane Doe 187UFMA found a few days prior in nearby New Britain, Connecticut. DNA has recently revealed that the two are closely related with a very high probability they are mother and daughter. Unlike Jane Doe 187UFMA, there were no spectacle or contact lenses found with the daughter. Perhaps matching Jane Doe's prescription eyewear to an exam record or an optician's patient record may aid in establishing the identities of these two ladies.

No reports of missing persons resembling the two Jane Does have been filed. This fact makes the case more difficult. Some speculation for this lack of missing persons reports include the possibility that the two are possible migrant workers or from a Native American community where travel over a large region may expected and may not be thought to be missing. If you are any of your colleagues have served migrant or Native American communities, please search your memories and if possible, your patient records in hope of a tentative identification. Eye care professionals serving the Albany area in the mid-nineties may be instrumental in the identification process, although the two have traversed a large geographical area, as discovered by assessment of isotopes in tooth and hair.



JANE 175UFCT (reconstruction by Charles E Holt, NCMEC and NCMEC)

Located on September 28, 1995, near a shopping center in New Britain, Hartford County, Connecticut. She was wrapped in two sleeping bags, killed likely elsewhere with a single gunshot to the head.

ESTIMATED DATE OF DEATH:
Recent

ESTIMATED AGE:
17-20 years old

APPROXIMATE HEIGHT AND WEIGHT:
5'3"-5'5"; 116 lbs.

DISTINGUISHING CHARACTERISTICS:
Dark brown/black hair. Her hair was styled up and held in place with bobby pins and an elastic ponytail holder. Brown eyes. Light complexion. She had a pierced navel with a silver navel ring and pierced ears.

CLOTHING:
She was wearing a brown/beige Croquet brand striped pullover shirt, size small; white Union Bay brand bibbed overalls, size small; white athletic socks; tan LA Gear brand shoes, size 6 1/2; a maroon bra.

JEWELRY:
A Gitano brand wristwatch, worn with the face on the inside of her wrist rather than the outside, a gold herringbone necklace, and a ring with a pink stone.

DENTALS:
Available. Good dental work.

With the development of the two Jane Does having a high probability of being mother and daughter, and the fact of refractive error often having a hereditary component, the daughter may have needed eye care. Perhaps someone will remember one or both of the two ladies visiting their eye care establishment or ordering spectacles. The unidentified ladies have apparently been associated with a large geographic area. Forensic isotope testing demonstrates that Jane Doe 187UFMA has been in the Northeast for several years and in the Albany, New York area, and additionally north and west of the area. She was also determined to have been along the East coast.

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IF YOU HAVE ANY INFORMATION ON THE TWO UNIDENTIFIED INDIVIDUALS, PLEASE CONTACT:

Lt. James Wardwell at New Britain Police Department, 860.826.3065, email james.wardwell@newbritainct.gov, New York State Police Troop G, Major Crimes Investigator Gloria Coppola 518.783.3210 ; Massachusetts State Police Detective Unit, Hampden County, 413.747.4810* Mon-Fri 8:30am-5:00pm; Massachusetts State Police Russell Barracks, 413.862.3312.

Sincerely,
E R Bertolli OD, *Private Practice, Adjunct Speaker Connecticut Police Academy, Director of the Forensic Optometry Division of the ACFEI, Connecticut Division International Association for Identification* ■

(information provided by the Doe Network, Massachusetts Investigators and Connecticut Investigators)

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DR. GREGORY E. BERG earned his BA in anthropology from the University of Arizona in 1993 and his MA from the bioarchaeology program from Arizona State University in 1999. He completed his PhD at the University of Tennessee in 2008. He is currently a forensic anthropologist and laboratory manager at the JPAC-Central Identification Laboratory in Hawaii, where he works on the recovery and identification of missing U.S. service personnel. He has over seventeen years of field experience in archaeology and physical anthropology and has presented or published numerous articles and papers in the *Journal of Forensic Sciences, Journal of Archaeological Science, Military Medicine, Journal of Forensic Identification,* and at various annual meetings. His recent research has concentrated on trauma analysis, aging techniques, human identification from eyewear, and intra- and inter-observer error studies. He is a fellow of the American Academy of Forensic Sciences.

DR. PANNONE, PhD, CMI-V is a behavioral optometrist who has been practicing in Norwich Ct. since 1960. He received his BS from U.R.I.1953, and his BS OD from Mass. College of Optometry 1958 (Beta Sigma Kappa). Dr. Pannone also studied at Gesell Institute of Child Development 1969, and today he deals with children's vision and learning problems. He is a member of American Optometric Association, and for 35 years has been a part of the Optometric Extension Program. He established the vision care and health section for the Haitian Health Foundation, Jeremie, Haiti in 1989 and still serves as a consultant. In 1990 he became a Connecticut State Police Surgeon, and today is an adjunct lecturer at the Connecticut Police Academy on Vision, Drugs and Alcohol and their effects on driving. He is a member of the American College of Forensic Examiners International. He has been a co- author on many peer reviewed articles. Dr. Pannone is a member of the DRE section of the IACP.