California Association of Criminalists
NEWSLETTER

DECEMBER 1981

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5. Abstracts from Other Regional Association Meetings

Material for the March 1982 Newsletter should be sent to the Editorial Secretary by the first week in March.

BRUCE DAVIS, 1949-1981

We are saddened to report the death of Bruce Davis, a forensic chemist at the ATF laboratory on Treasure Island. He was killed in an auto accident in San Mateo, 25 October, 1981. Bruce will be missed by all who knew him; not only was he a true professional, dedicated to and enthusiastic about his work, he was also a joy to those around him.

A native San Franciscan, Bruce served a four year stint in the Navy (1971-1975) and attended Cal State University at Sacramento where he earned a B.S. in Chemistry in 1977. Joining ATF in 1978, Bruce instructed numberous bomb scene investigation schools throughout the western states and was involved with the laboratory examination of bomb evidence from several hundred incidents. He was a member of the ATF National Response Team for bomb and arson investigations and participated in many bomb scene investigations.

Bruce leaves a wife, Kay, and daughter, Irene. Bruce's colleagues at ATF have established a college education fund for Irene. Donations should be made payable to Kay Davis and sent to Elliott Byall at the ATF laboratory, Treasure Island, California 94130.

ASSOCIATION ACTIVITIES

Northern Section Meeting

A dinner seminar hosted by the San Mateo Police Department Laboratory was held in October. Dr. Giles, a local Forensic Ondontologist, was the speaker. His presentation concerned the evidentiary value of bitemarks; he illustrated his presentation with examples of his own casework.

The next dinner meeting will be held in early January 1982. It is scheduled to be hosted by the Serological Research Institute.

Southern Section Meeting

A dinner meeting in October featured Lance Martini, a gunsmith from the San Diego area, talking on accelerated cartridges and their implications for firearms analysis. The January dinner meeting will be hosted by Rich Whalley in San Diego; the speaker will be Milt Silverman who will talk on "Physical and psychiatric evidence and the criminalist in defense of the accused".

Study Group Meetings

1. Southern Trace Group. The group met in November to hear Gretchen Sibley of the L.A. Museum of Natural History speak on methods of species classification of animal hair.

2. Southern Serology Group. The group met in December to discuss sperm survival in the vagina. Relevant articles were reviewed.

3. Northern Trace Group. The study group last met in September in Contra Costa County. The speaker at this meeting was Dr. Di Giorgio of Sacramento State University who discussed infra-red spectrophotometric examination of synthetic fibers.

ON STAYING WITH THE CAC

John DeHaan
DOJ, Sacramento

[This opinion originally appeared as part of an editorial in the DOJ TIE-LINE.]

The CAC is something of which we can be proud. It is the oldest of the regional forensic organization and people all over the country look to it for leadership in new and better ideas.

It's not without its warts, however. We have had some rocky times recently. But things are rarely smooth for the pioneers and we have been pioneers in establishing and testing a code of behavior. We made some mistakes; but we learned from each one. We are now better able to handle new challenges more quickly and more fairly than ever before. The recent controversy in England about Clift and Horncastle shows us just how much better off we are. Our esteemed colleagues in the Forensic Science Society are now bitterly divided and have even turned against their Board of Directors. Some have radically demanded instant and complete ouster and a tree-stump election of new officers. Respected scientists have made outrageous statements to the press about their own colleagues. The turmoil surrounding the Society and its members is in marked contrast to the "troubles" within the CAC.

A professional organization is a ship that requires many years to build and fit. It takes energy to get it moving and keep it moving and needs an able crew to keep it on course. The parallels are striking. The Academy, seaworthy as it is, is so large and massive of inertia that mere mortals can no longer change its course. It is the supertanker of organizations. Requiring a large crew, it is not speedy or responsive but it does get the job done. Newer forensic organizations are small sailing craft - still drifting about to find their course; a bit leaky as they cross the same rough seas CAC has crossed; and easily swamped. The CAC is the largest and fleetest of the "Cape Horn" sailing ships. Requiring a steady hand on the wheel and an eager crew, that's true. But capable and efficient in the face of rough weather, it is indeed.

Unfortunately, our recent troubles have prompted some valued and long-time members to bail out, taking to rough seas in small, separate lifeboats. This is certainly not a logical decision in lieu of staying with our nearly caulked but most seaworthy ship.

Stay with the ship. Help it stay on course, setting new directions for others to follow without effort. It will cost something. But it costs less than you make in four hours to maintain your kit aboard for a whole year. But you and your profession will be better prepared for the voyages ahead.

BOOK NOTES

by

John DeHaan
DOJ Sacramento

For those of us who have puzzled over paints and polymers every time they occurred in a forensic case, it is a pleasure to announce that there is finally a comprehensive book dealing with paint chemistry and technology which treats all of the fundamentals of paints and finishes in a form which even a criminalist can understand. Introduction to Paint Chemistry and Principles of Paint Technology, by G.P.A. Turner (about $12; Chapman and Hall, Ltd., 733 Third Avenue, New York, NY 10017) has been released as a second edition. It has been extensively updated since the first edition was published in 1967 and is a very readable and yet comprehensive treatment of the subject.

At long last, there is a new comprehensive book that deals with all methods of both preserving and interpreting footwear impressions. Footwear Identification is the title of a new softbound book by Sgt. Michael J. Cassidy of the RCMP in Ottawa, Canada. This well-organized manual covers general crime scene investigation and the preservation of both three-dimensional and two-dimensional footwear impressions at scenes. There is a brief but comprehensive chapter on the manufacturing of shoe soles and heels by a variety of manufacturing processes which is of considerable value to forensic practitioners but is rarely discussed. The identification process of shoe impressions is discussed in terms of the number of characteristics and the general philosophy of identifying footwear as opposed to fingerprints and toolmarks. The effects of a subject's age, height and sex on the walking patterns observed in a series of impressions is described as a method for developing investigative information. This is altogether a most useful book and should be on the reference shelf of every criminalist. Copies are available from the Canadian Government Publishing Center, Supply and Services, Canada, Hull, Quebec, Canada K1A 0S9 at $9.55. Catalog number - JS 62-36/1980E.

At long last, Alcohol and the Impaired Driver has been reprinted. The original text, copyrighted in 1970, was published by the American Medical Association and was the basis for much of our training in forensic alcohol. Since 1976, the National Safety Council has been responsible for this publication. The 1976 edition includes virtually all of the material from the original text on the general topics of Alcohol/Traffic Safety, Pharmacology, Effects of Alcohol on the Nervous System and Driving Ability and Chemical Tests for Alcohol Measurement. These chapters do not appear to have been substantially updated. The most significant change to this 1976 edition is the addition of a supplement on breath alcohol tests. Once again, the lack of currency of some of these devices is a shortcoming of the text. Since this book is still regarded as a source book in its field, it is important to know that it is once again available after having been out of print for some years. Copies are available from the National Safety Council, 425 North Michigan Avenue, Chicago, IL 60611 at a price of about $8.90 per single copy.

The Behavioral Sciences Media Laboratory of the Neuropsychiatric Institute, UCLA, has prepared a series of five films (16 mm, color) designed as teaching aids for alcohol and traffic safety education. The five films are: Impairment (7 minutes, $100 sale or $20/week rental), Alcohol, the Brain, and Behavior (12 min, $185 or $25/week), Alcohol and the Driving Task (15 min, $210 or $25/week), Alcohol Tolerance (10 min, $140 or $20/week), and Alcohol and Drug Interaction (8 min, $125 or $20/week). The five films are available as a package (52 min, $760 sale or $110/week rental). Obtainable from the Behavioral Sciences Media Laboratory, Neuropsychiatric Institute, UCLA, 760 Westwood Plaza, Los Angeles, CA 90024.

UPCOMING MEETINGS

California Association of Criminalists

The Spring 1982 Seminar is scheduled for 7-9 May (Mother's Day weekend) and will be hosted by the Orange County Sheriff's Dept. Contact Larry Ragle, Orange County S.O. Criminalistics Laboratory, P.O. Box 449, Santa Ana, CA 92702, (714) 834-3000.

American Academy of Forensic Sciences

8-11 Feb. 1982. Orlando, Florida.

Northwest Association of Forensic Scientists

28-30 April, 1982. Seattle, Washington. Contact K.M. Sweeney, Washington State Patrol Crime Laboratory System, Public Safety Building, Seattle, WA 98104, (206) 464-7074.

Southern Association of Forensic Scientists

29 April - 1 May 1982. Savannah, Georgia. Contact Brian Bouts, Columbus Branch Crime Lab, Midland, GA 31820.

Midwestern Association of Forensic Scientists

12-14 May 1982. St. Louis, Missouri. Contact Robert Briner, SEMO Regional Crime Lab, Cape Girardeau, MO 63701.

California Association of Criminalists - First Inter-American Congress of Forensic Sciences

1-5 Nov. 1982. Sacramento, California. Contact John DeHaan, Calif. Dept. of Justice Laboratory, Box 13337, Sacramento, CA 95813.

International Association of Forensic Sciences

Summer 1984. Oxford, England. Contact IAFS, c/o Forensic Science Society, P.O. Box 41, Clarke House, Harrogate, North Yorkshire, GH1 1BX, England.

EMPLOYMENT OPPORTUNITIES

ASSISTANT LABORATORY MANAGER, Ventura County.

Requires at least a B.A. or B.S. with a major in Criminalistics or a relevant natural or physical science and five years experience in analytical work, including one year in a supervisory or administrative capacity. Responsibilities, under the general direction of the Laboratory Director, include administrative, operational, and staff supervisory activities. Contact or send resume to Dr. A.K. Bergh, Director, Ventura County Crime Laboratory, 501 Poli Street, Ventura, CA 93009, (805) 654-2332

SEROLOGISTS OR SEROLOGY TRAINEES, State of Virginia.

The Commonwealth of Virginia is seeking two Serologists or Serology Trainees, one for its Tidewater Regional Laboratory in Norfolk, VA and another for its Central Laboratory in Richmond, VA. Minimum requirements include knowledge in the basic concepts of chemistry, biology and/or natural sciences; ability to perform accurate laboratory analysis independently; ability to express themselves in a clear, concise manner in both verbal and written communication. Prefer a baccalaureate degree in a physical or natural science; contact Warren G. Johnson, Director, Bureau of Forensic Science, P.O. Box 999, Richmond, VA 23208, (804) 786-2281.

ASSOCIATE OR FULL PROFESSOR, Northeastern Univ., Boston.

Requires Ph.D. in Chemistry, Medicinal Chemistry, or related field and research experience in Toxicology. Responsibilities include teaching at undergraduate and graduate levels, supervision of graduate research, and establishment of an original research program. Contact Dean Robert Croatti, College of Criminal Justice, Room 144 Knowles-Volpe Hall, Northeastern Univ., Boston, MA 02115, (615) 437-3327.

CRIMINALIST, Fresno County Laboratory.

Requires bachelors degree in chemistry, criminalistics, biochemistry, physics, or pharmacy and one year laboratory experience. Contact Gary Kirchner, Fresno County Personnel, 3rd Floor, Townehouse, Fresno, CA 93721, (209) 488-3364.

SEROLOGIST, Binghampton, New York.

Contact Captain S. Ferris, Southern Teir Regional Crime Laboratory, P.O. Box 213, Town Hall, Port Crane, New York 13833, (607) 648-4127.

CRIMINALIST-MICROANALYST, Tampa, Florida.

Opening in microanalysis section. Contact Sandra Lopez, Chief of Personnel Management, Department of Law Enforcement, P.O.Box 1489, 408 N. Adams St., Tallahassee, FL 32302 (904) 488-4814.

ETHICAL DILEMMA

By Peter D. Barnett
Forensic Science Associates

The last ethical dilemma dealt with a technical problem rather than the more legal issues dealt with previously. As Jim White pointed out, "Historically, being a poor criminalist has been held not to be a violation of ethics". It seems to be a generally held belief that the CAC Code of Ethics does not deal with technical competence. There are, however, a number of sections of the Code of Ethics which require, at least,a minimal level of performance:

> "...he will use all of the scientific means at his command to ascertain all of the significant physical facts relative to the matters under investigation" (Introduction)
>
> "The true scientist will make adequate examination of his materials, applying those tests essential to proof." (Section I. A.)
>
> "Where appropriate to the correct interpretation of a test, experimental controls shall be made for verification" (Section II. C.)

These sections, and perhaps others, deal with technical competence or performance. It is of interest, then, to consider how to decide whether,in a particular situation, a criminalist met the minimum technical standards required by the Code of Ethics.

In a murder case the fatal bullet recovered from the body of the victim was booked into the property room without ever having been examined. Sometime later, a search warrant served on a suspect resulted in the seizure of a Colt Trooper .357 Magnum revolver and some unfired .357 Magnum ammunition. A request was sent to the crime lab requesting examination of the fatal bullet and comparison of this bullet with the gun and ammunition recovered from the suspect.

All of the evidence was examined by the criminalist, the gun test fired and a report written which, in essence, stated the following conclusions:

1. The fatal bullet was too damaged to permit comparison with the recovered weapon.

2. The fatal bullet was fired in a weapon with 6 left rifling.

3. The class characteristics of the fatal bullet are "peculiar" to Colt revolvers.

At trial the criminalist's testimony was essentially the same as his report. He left the impression, at least in the mind of the defense attorney, that he had found the class characteristics of the Colt and the fatal bullet to be the same, and that he was only unable to make a positive identification because of the damage to the fatal bullet.

Examination of the evidence by a defense consultant revealed that, indeed, the fatal bullet was badly damaged but that there were several areas which had engraving which appeared promising for comparison purposes. Examination of the Colt revolver revealed that it was rifled 6 right, an unusual characteristic but certainly not unheard of.

During the cross-examination the defense attorney asked the law enforcement criminalist to re-examine the gun and describe its rifling characteristics. After several minutes the criminalist stated that the rifling was 6 right.

From the above facts it is apparent that the law enforcement criminalist had every opportunity to determine the difference in the rifling between the fatal bullet and the suspect's gun. (Clearly, if this determination were made, but not reported, it would constitute an ethical violation as well as a violation of law.) Is the fact that this difference was not noted during the original examination a violation of the criminalist's responsibility to "use all of the scientific means at his command", or to "make adequate examination of his materials", or to use "experimental controls"?

The previous ethical dilemma produced a veritable flood of responses - at least in comparison with the past. None of the respondents felt there was a clear violation in any event. Most people felt that the case demonstrated some technical shortcomings on the part of the analyst, but this "has not been held to be a violation of ethics".

Art Terkelson and Victor Reeve both felt that alternative B (which includes the possibility that the semen is from an AB secretor) is a reasonable interpretation of the evidence. Dave Sanchez and Arnie Bergh felt that the data do not justify such a conclusion. Jim White suggests that more tests be done to try and resolve the situation.

The comments of the above individuals and others who have given verbal comments, are appreciated. I hope that more members will take the time to jot down some thoughts and send them to me. Although I generally think people should take credit for what they say, if anyone wishes to remain anonymous just leave your name off the reply sheet.

Response to January Ethical Dilemma

The report is a violation of Section(s) _____

_____

of the CAC Code of Ethics.

The testimony is a violation of Section(s) _____

_____

of the CAC Code of Ethics.

There is no violation of the CAC Code of Ethics.

Return To: Peter D. Barnett, Forensic Science Associates
P. O. Box 8313, Emeryville, Calif. 94608

A GLOSSARY OF KNIFE TERMINOLOGY

L. F. Harding, Redding Laboratory

[From the DOJ TIE-LINE by permission]

Since knives are frequently used in crimes and submitted as evidence, it is often necessary to describe the location of a mark or stain on a knife in unequivocal terms. Most criminalists are familiar with the terminology of firearms, chemistry or even automobiles, but are unaware that a similar vocabulary exists in the world of knife afficionados (or even that such a world exists).

Although many of the words are not widely known outside the world of knife manufacturers and collectors and are probably not even practical for daily use (unless everybody reads this), the knowledge could help to lessen confusion and improve precision in descriptions. Also, knowing the accepted meaning of the words can help to avoid their misuse.

The following glossary and illustrations are derived from a column about knife collecting entitled "All About Knives", by William R. Williamson, in the July 1977 issue of Guns & Ammo.

Glossary

BACK: The edge of the blade opposite the true edge (q.v.).

CHOIL: The offset between the true edge and the ricasso if the ricasso is not in line with the true edge.

FALSE EDGE: Any sharpened portion of the blade back (see SWAGE).

FERRULE: A metal piece between the guard and scales, either for decoration or to prevent the scales from splitting.

FULLER: Commonly called a blood groove; a groove running lengthwise of the blade on one or both sides near the back.

GUARD: A metal piece between the blade and handle, originally designed to keep the user's hand on the handle and to prevent another blade from overriding the handle.

HANDLE: The non-blade portion of the knife (see SCALES, GUARD, POMMEL, FERRULE).

HILT: A sword term, not properly used with reference to knives.

KNIFE: Strictly, a single edged short weapon or untensil, possibly with a second or 'false' edge on the back for a portion of its length. Two full-length edges are indicative of a dagger or dirk, and there are other forms with other names as well, all of which are popularly called 'knives'.

OBVERSE SIDE: The opposite side of the blade from the reverse side (q.v.).

POMMEL: A metal or other hard tip or decoration on the end of the handle.

QUILLION: Any long extension of the guard, whether functional or decorative.

REVERSE SIDE: The side of the blade towards the observer when the handle is to the right, the point to the left and the true edge down. Also called the 'mark' side in England because the marker's mark is usually on this side.

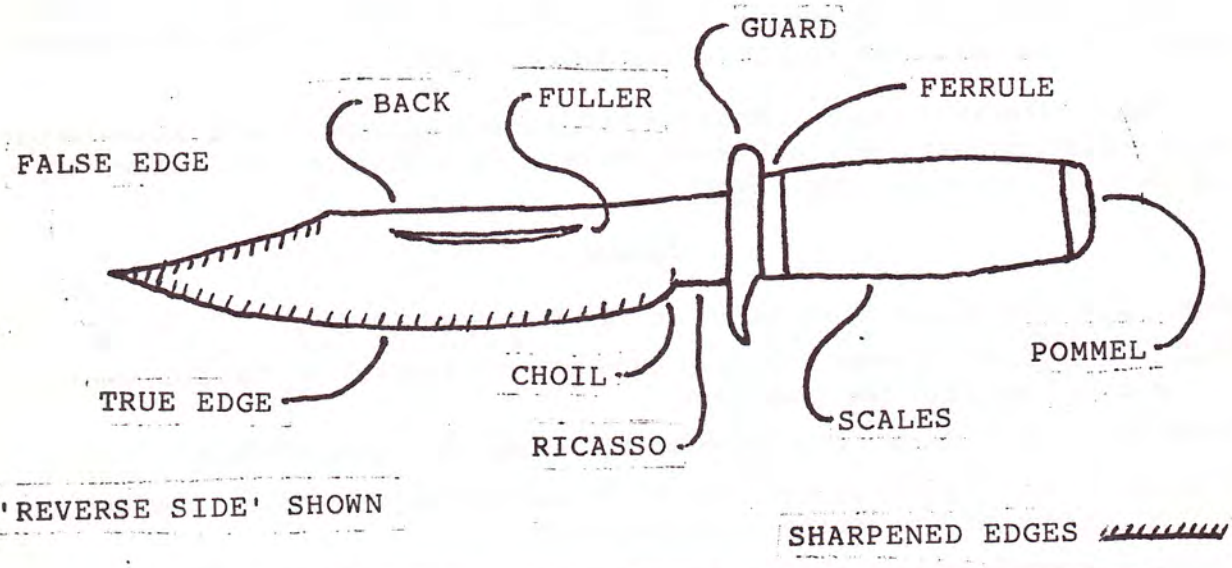
RICASSO: Any short unsharpened section of blade between the true edge and the guard, sometimes indented (see CHOIL).

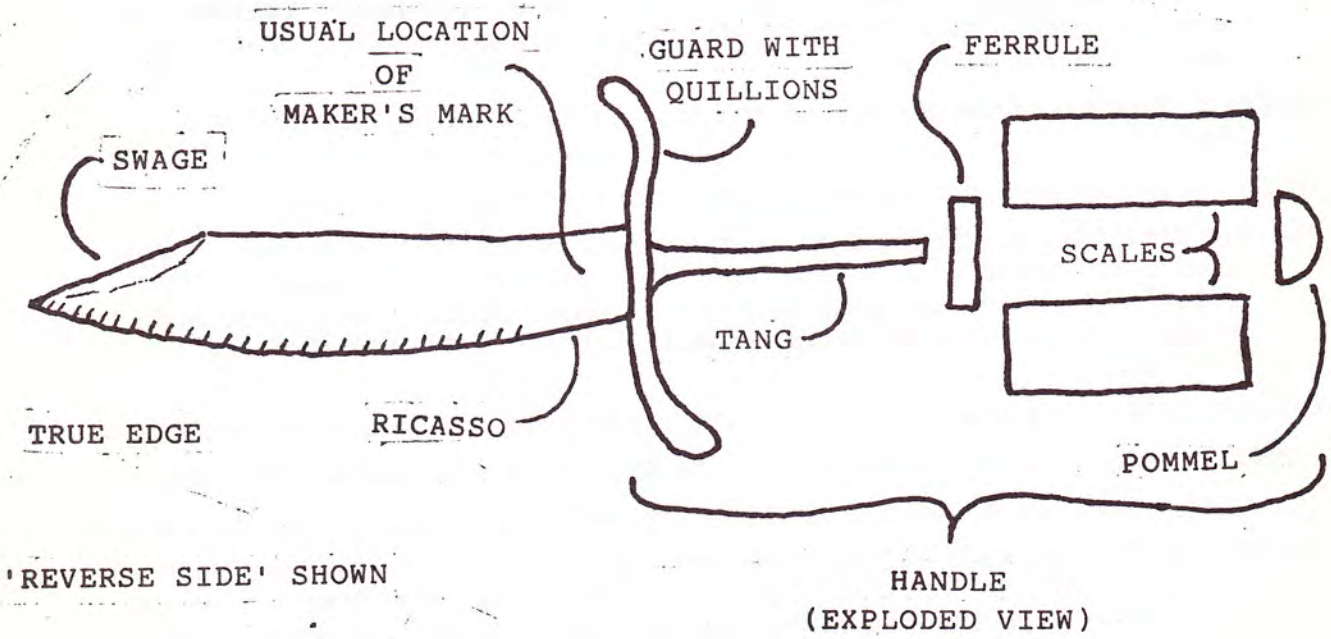
SCALES: Added material (ivory, bone, wood, etc.) to give thickness and a good grip to the handle. Often decorative.

SWAGE: A section of the back thinned but not sharpened (see FALSE EDGE).

TANG: The extension of the blade through the handle. May be narrow or as wide as the handle.

TRUE EDGE: The edge of the knife used for primary cutting, usually sharpened nearly the entire length.





FIBER CROSS SECTIONING

Sandy Wiersema

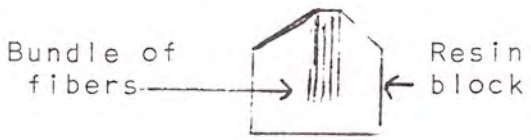
MICROTOME METHOD

Equipment: Sledge microtome
Coplan jar
Porcelain casseroles
Hanau dental torch
2 - 1" thick aluminum L-shaped blocks
3/8" thick aluminum plate

Reagents: Imbedding resin - Versamid 940*
Meyers Adhesive - 1 egg white strained through cheesecloth and an equal amount of glycerin
Solvent - isopropyl alcohol/toluene (50:50)

Procedure for bundle of fibers:

Place resin chips in casserole and melt on hot plate. Holding both ends of a bundle of fibers, dip the center section of the bundle in the melted resin and draw tightly until the resin hardens. Trim the protruding fibers from one end of the resin. Pour melted resin into the aluminum blocks which are resting on the aluminum plate. Insert the trimmed end of the resin coated bundle of fibers into the warm resin and hold until cool. Remove the aluminum blocks. Heat both sides of the resin block just until soft, with the Hanau torch. Trim the resin block to a pyramid shape while still warm. See below:



Mount the resin block in the microtome with the fiber bundle perpendicular to the knife blade and cut sections 2-10 microns thick.

Coat a microscope slide with a very thin coat of Meyer's Adhesive and arrange 7-10 sections on the slide. Place the slide on a heating block at 100°C and heat until resin becomes transparent. Cool slide and place in the Coplan jar with isopropyl alcohol/toluene for 1½ to 2 min. Remove the slide from the solvent and wipe dry, avoiding the sections.

Mount sections in appropriate Cargille liquid.

Bright field: 0.03 difference from refractive index of fiber

Phase contrast: ± 0.01 from average refractive index of fiber

*Available from Henckel Corp., Kankakee, Illinois

Procedure for a single fiber:

Stretch and tape the fiber to the aluminum plate. Pour a small amount of melted resin over the fiber, avoiding the tape. When cool, turn the fiber over and coat the other side with resin.

Follow the above procedure for trimming and sectioning the resin block.

HARDY MICROTOME METHOD

Insert the fiber bundle or single fiber surrounded by a bundle into the slit of the Hardy Microtome. Trim both sides of the fiber bundle with a razor blade. Position the plunger over the slit and tighten just until the fibers become visible above the back plate of the Microtome. Coat the protruding fibers with Collodian and allow to dry. Cut the section with a razor blade and mount on a microscope slide. The first section should be discarded. A new razor blade should be used for each section. I find it easier to do all of the sectioning under a stereo microscope at 10X.

SandyWiersema

8-14-81

Human Scalp and Pubic Hair: A Comparison of Physical Properties

John D. DeHaan

Pubic hair is frequently encountered in physical evidence from rape and homicide cases. It is a common request that the age, race and complexion of the subject be determined from an examination of hairs left at the scene or upon the victim. In cases where dismemberment or advanced decomposition has taken place, the pubic hair may be the only available clue as to the race or description of the victim. It seems that a study of the correlation between the color and other gross morphological features of pubic hair and those of the scalp hair would yield guidelines on how reliably race and complexion can be estimated from an examination of the pubic hair itself. Although head hair has been studied in some depth in both the forensic and anthropological literature (Hausman, 1925; Trotter, 1930, 1938; Porter and Fouweather, 1975; Kirk, 1940) no such study on pubic hair has been published. This presentation will discuss the preliminary results of such a study being carried out at California Department of Justice Laboratory in Sacramento.

Method:

Previous forensic and anthropological investigators have determined that color is the predominant feature of all types of human hair. A means of reproducibly categorizing the color of the hair shaft is therefore needed. This, in itself offers some considerable problems, for hair owes its apparent color to the distribution of pigment within the cortex of the shaft, and to the texture and reflective properties of the outer protective layer, the cuticle.

Early anthropological studies on human hair color depended on subjective word pictures (yellow-brown, blonde, red-blonde, etc.) or on the use of a comparison chart using artificial cellulose "hair" or tufts of artificially dyed human hair (Trotter, 1939). A recent study of this problem by the Home Office Central Research Establishment (Porter and Fouweather, 1975) concluded that the use of Munsell colbr chips or dyed nylon fiber tufts was generally unsuitable. The major objection to the use of the Munsell chips was that the comparison of a flat color surface with a textured material such as human hair is highly subjective due to the variability of the texture and reflective properties of the hair itself. A color comparison method using dyed nylon tufts was found to be usable but was suitable only for characterizing tufts of human hair. The use of a microspectrophotometer was also ruled out due to its normal limitation of requiring tufts of hair, an occurrence rare in forensic situations.

Since microscopy is a routine means for hair examination, it was decided that categorization of hair color by microscopic evaluation would overcome the reflective contributions of the cuticle and would standardize the illumination and observation procedures. With the use of critical illumination by a light source having a reproducible color temperature at low magnification, the reflective properties of the cuticle are minimized. Since normal hair microscopy is carried out in transmitted light, a semi-transparent medium for color comparison would be best, thus simulating the diffusely pigmented, semi-transparent

optical properties of the hair shaft (cortex) itself. Since Munsell color charts are already available in many laboratories as a reproducible color standard, a number of Munsell color chips were selected to typify the range of colors found in human hair. These chips were then photographed using a Nikkormat medical closeup lens with co-incident electronic flash on Ektachrome and Kodachrome slide film. After processing, the slides were examined to determine which colors most closely approach the colors found in human hair. It was found that all of the color chips recorded on Ektachrome film were shifted into the blue region, making them unsuitable for comparison to the yellows, reds and browns of human hair. Many of the chips recorded on Kodachrome film were comparable and a series of colors were selected by trial and error.

During the C.R.E. study on human hair, it was determined that the use of more than nine color categories was undesirable since hair could vary considerably over a single scalp and more precise color matching would be unproductive. Since many of the anthropological studies used a similar number of subjective color categories, a set of ten colors was selected: white/gray (colorless), light blonde, blonde, red blonde, red, red-brown, brown, dark red-brown, very dark brown and black (opaque/ blue-black).

A Munsell chart slide was selected to represent each category and the selected slide was cut into thin strips. The final color selections were as follows:

Color	Color Category	Munsell Color Chip
White-gray	0	10 YR 8/2
Light blonde	1	10 YR 8/6
Blonde	2	7.5 YR 6/4
Red-blonde	3	10 R 5/6
Red	4	2.5 YR 6/6
Red-brown	5	2.5 YR 4/6
Brown	6	5 YR 3/2
Dark brown	7	2.5 YR 3/4
Very dark brown	8	10 R 2/2
Black	9	2.5 Y 2/0

Each strip can then be manipulated into the field of view during examination of hair for direct comparison. When a fiber comparison microscope with matched light sources is available, a set of all ten color film slips can be mounted side-by-side on a microscope slide for ready access.

Experimentation with this method revealed that the semi-transparent slide film closely simulates the optical properties of the hair shaft. Even at low magnification, natural hair shaft coloration is not uniform, but is often streaky, patchy or irregular. The dyes used in the photo film are similarly non-uniform and therefore, make comparison even more direct. Test samples of human hair were classified by five different observers with excellent agreement. The use of only ten color categories leaves few options for possible ambiguity. The only exception to this appears to be a small class of hairs whose color falls between red-blonde and brown and each observer must make a subjective decision as to

whether the hair has sufficient red in its color to permit its inclusion in that category. Several rolls of film were exposed at different times in the course of color evaluation and processed by the Kodak factory. There was excellent agreement in color between successive rolls developed at different times.

With a reproducible color categorization method in hand, the study proceeded to the hair comparison itself. Volunteer donors (most of whom were employees of the D.O.J. Crime Lab System) submitted samples of scalp and pubic hair which were selected at random. Hairs were plucked, combed, or cut close to the skin by each donor, packaged, and submitted, along with data on the donor's age, race, sex and type of hair preparation used. Between eight and ten hairs were selected at random from each specimen and were dry-mounted under standard cover slips for examination. The color and diameter of each hair were determined at the medial portion of the hair shaft. It was noted that the color of human hair may vary considerably along the length of each hair, with the largest variation occurring near the proximal (root) end, where the color normally becomes lighter than at its distal or medial portion. The only exceptions to this procedure were made when visual observation revealed that the natural color was changed by bleaching or dyeing. In these cases, the color at the proximal end tended to be the closest approximation to the hair's natural color and was recorded as such. Each hair was observed in the direction of its minor diameter and the color present was compared directly with the color strips until a category was assigned. This examination was carried out on a Leitz Orthoplan microscope at 63X using critical transmitted illumination from a 2850°K incandescent source. Pubic hair was found to exhibit considerable variation in its color along its length. As a result, the predominant colors of both distal and medial portions of the hair shaft were recorded as representative of the colors which may be found as broken hair fragments in evidence. During the categorization process, each analyst listed the color categories found in the specimen in order of the frequency of occurrence. To simplify the analysis of hair relationships later on, the two predominant color categories of each specimen were recorded for later use.

The diameters, both major and minor, of the medial portion of each shaft were then measured on a comparison microscope on one stage of which was mounted an engraved glass stage micrometer, calibrated in 0.01 millimeter (ten micron) increments. When hairs (typically pubic hairs) having a markedly oval cross section were encountered, the major and minor diameters were measured along each hair as the hair shaft could be observed to twist on its own axis. For rounder hairs the twist is not as apparent and the diameters were measured at random.

Finally, the degree of waviness of the intact hairs was recorded by subjective comparison to a sinusoidal wave curve with dimensions as below:

1. Straight to slight curve (two inches or greater = one-half wavelength) 
2. Loose wave (one inch = one-half wavelength) 
3. Moderate wave (one-half inch = one-half wavelength) 
4. Tight wave (one-quarter inch = one-half wavelength) 
5. Very tight wave, curly (one-quarter inch diameter curls) 

This categorization was carried out on intact scalp and pubic hairs as received before being dampened or sectioned to facilitate mounting. Double or split assignments were made only when an almost equal mixture of wave types was noted in the bulk hair specimen.

Results:

Plots of the wave character of pubic hair versus the waviness of scalp hair from the same individual are recorded in Figures 1 and 2. The results for subjects of different racial origins are denoted by the marker figures. The results for the present sample population of 52 males and 28 females were recorded separately, although it was noted that the distributions for males and females overlap to a large extent.

FIG. 1

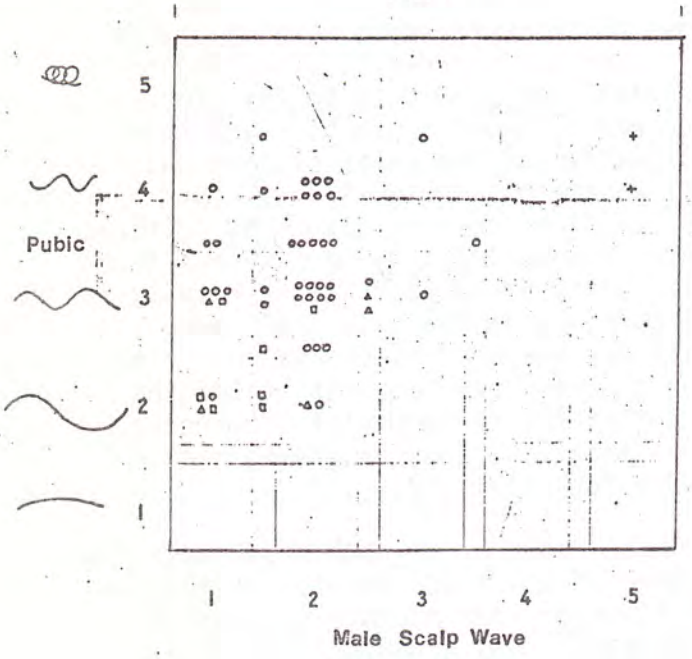
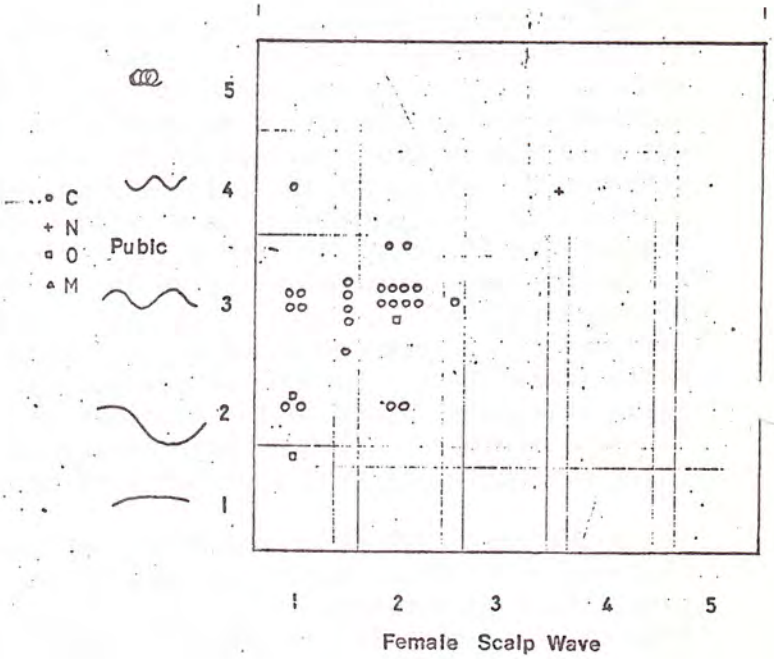


FIG. 2



It was found that most Caucasians, both male and female, had moderately or tightly waved pubic hair and straight to loosely waved scalp hair. As expected, Negro pubic and scalp hair possesses tightly waved or curly class characteristics. Individuals of Oriental origin tended to have straight or nearly straight scalp hair and only loosely waved pubic hair. Individuals of "Chicano" or Mexican ethnic origin tended to have straighter pubic hair than most other Caucasians. This particular ethnic group originated from inter-breeding between Spanish Caucasians and native Indians (Mongoloid). The overlap between racial groups in their heritage appears to be reflected in their hair characteristics.

Most of the individuals included in this study had scalp hairs which fell into two or three color categories. Pubic hairs from these individuals, however, often fell into three or even four color categories. On a microscopic level, no single color category can normally be assigned as a representative of an individual's scalp. As a result, each time a color category was encountered as one of the two or three predominant hair colors of a specimen, it received one tally. Thus, a single hair specimen could be responsible for tallies in as many as three color

categories. This procedure was recorded for the pubic and scalp hairs of each of the 52 males and 28 females in the study. The frequency distribution of colors for scalp and pubic hairs for males in recorded in Figure 3 and that for females in Figure 4. For Caucasians, the most common scalp hair colors are dark blonde (2) and brown (6) (by transmitted light). For Orientals and Negroes, the most common scalp hair colors appear to be brown (6) and dark brown (7). There appears to be a minimal overlap between the colors encountered in Caucasian scalp hair and those found in Oriental or Negro scalp hair.

FIG. 3 COLORS -- MALE

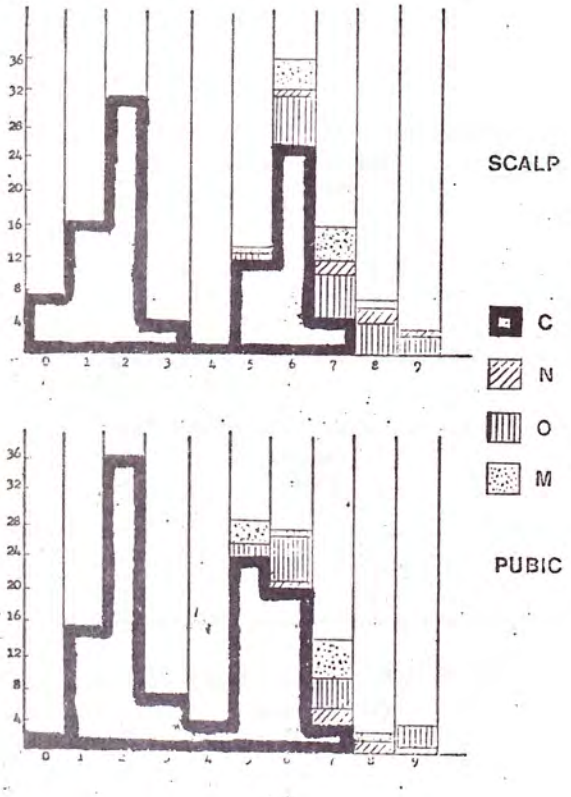
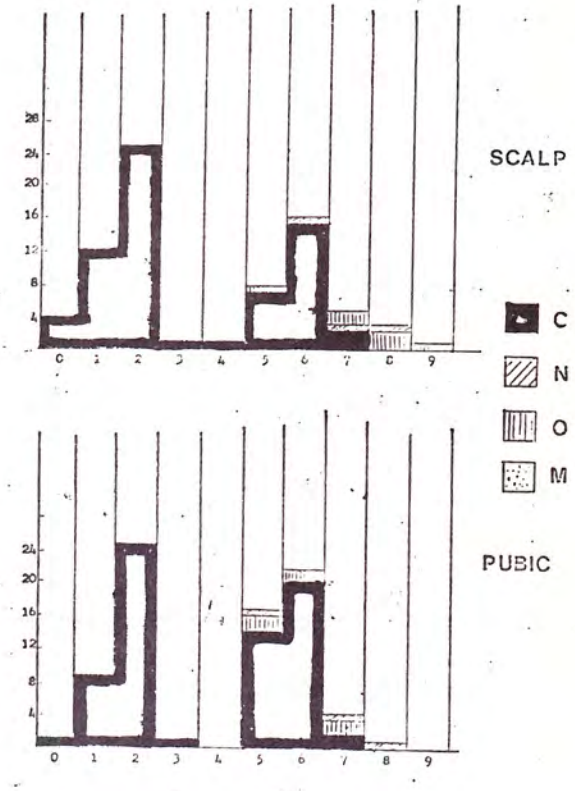


FIG. 4 COLORS -- FEMALE



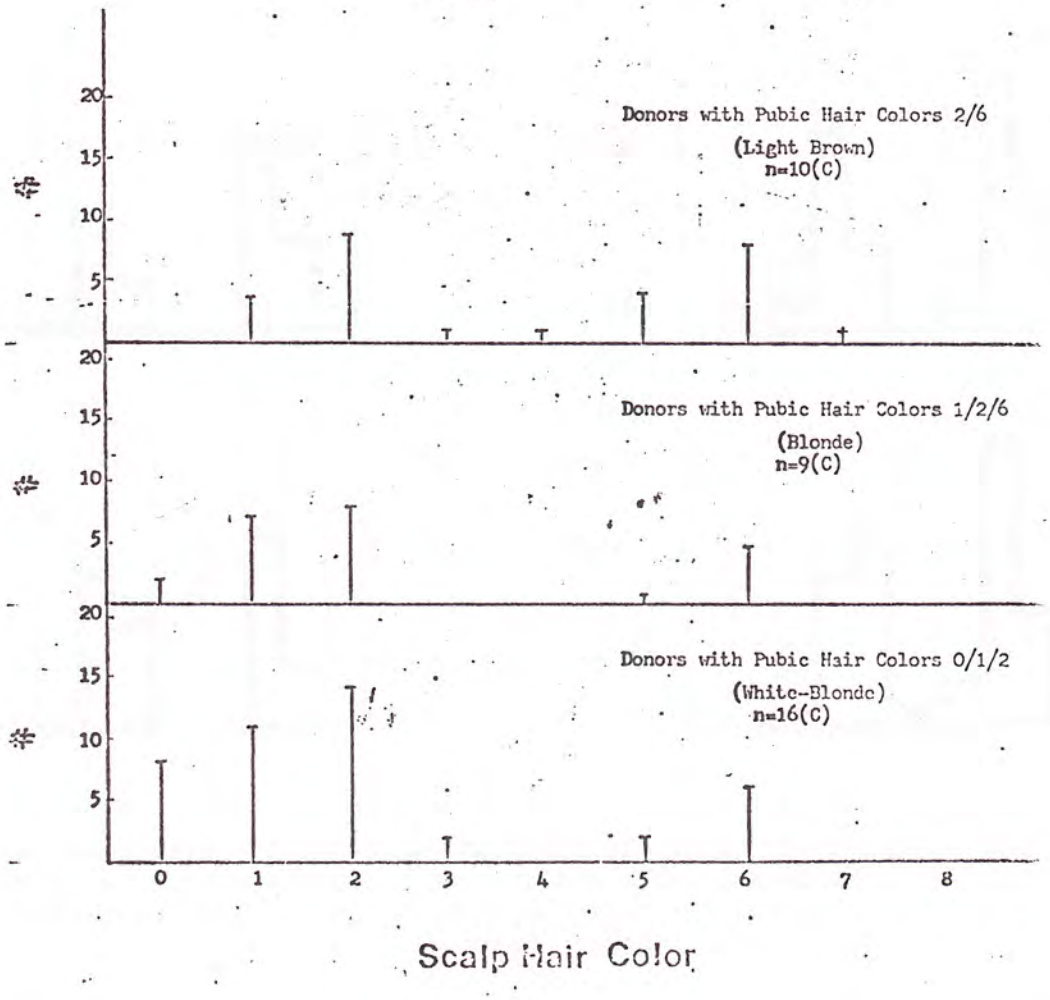
For pubic hair, a similar color distribution is found, but with fewer white or blonde hairs and considerably more red and red-brown hairs from Caucasian subjects. For non-Caucasian subjects, the pubic hair color distribution is shifted to lighter colors than those encountered in scalp hairs.

The subjects were then grouped according to their predominant pubic hair colors in the following manner:

Pubic Hair Colors	0/1/2	White-blonde
" " "	1/2/6	Blonde
" " "	2/6	Light brown
" " "	2/5/3	Red-brown
" " "	5/6/7	Dark red-brown
" " "	6/7/8	Dark brown
" " "	7/8/9	Very dark brown

For each group the predominant scalp hair colors were tallied, as shown in Figures 5 and 6. For each group, it can be seen that there is good general agreement between the colors of pubic hairs and those of scalp hairs. As the predominant pubic hair colors shift from blonde to red-brown to very dark brown, so do the most common scalp hair colors. For all but the darkest pubic hair groups, there is a substantial frequency of blonde scalp hairs occurring as well.

FIG. 5



The numerical average of the major and minor diameter measurements was calculated for both scalp and pubic hairs. The average major diameter of the pubic hair was plotted against that of the scalp hair for each donor, and the results are recorded in Figure 7. Similarly, the average minor diameters of scalp and pubic hairs were plotted in Figure 8. It can be seen that there is apparently no direct dependence between the diameters of the pubic hair and those of the scalp hair for an individual. There appears to be no racial dependence for the average diameter of either hair, with a random distribution of diameters for all racial origins. This finding is contrary to that reported by early anthropologists who reported a dependence of head hair diameter on ethnic origin. This may have been due, in part, to the absence of racially mixed individuals in the earlier studies. Very vew racially or ethnically uniform individuals are found in American populations at the present time.

FIG. 6

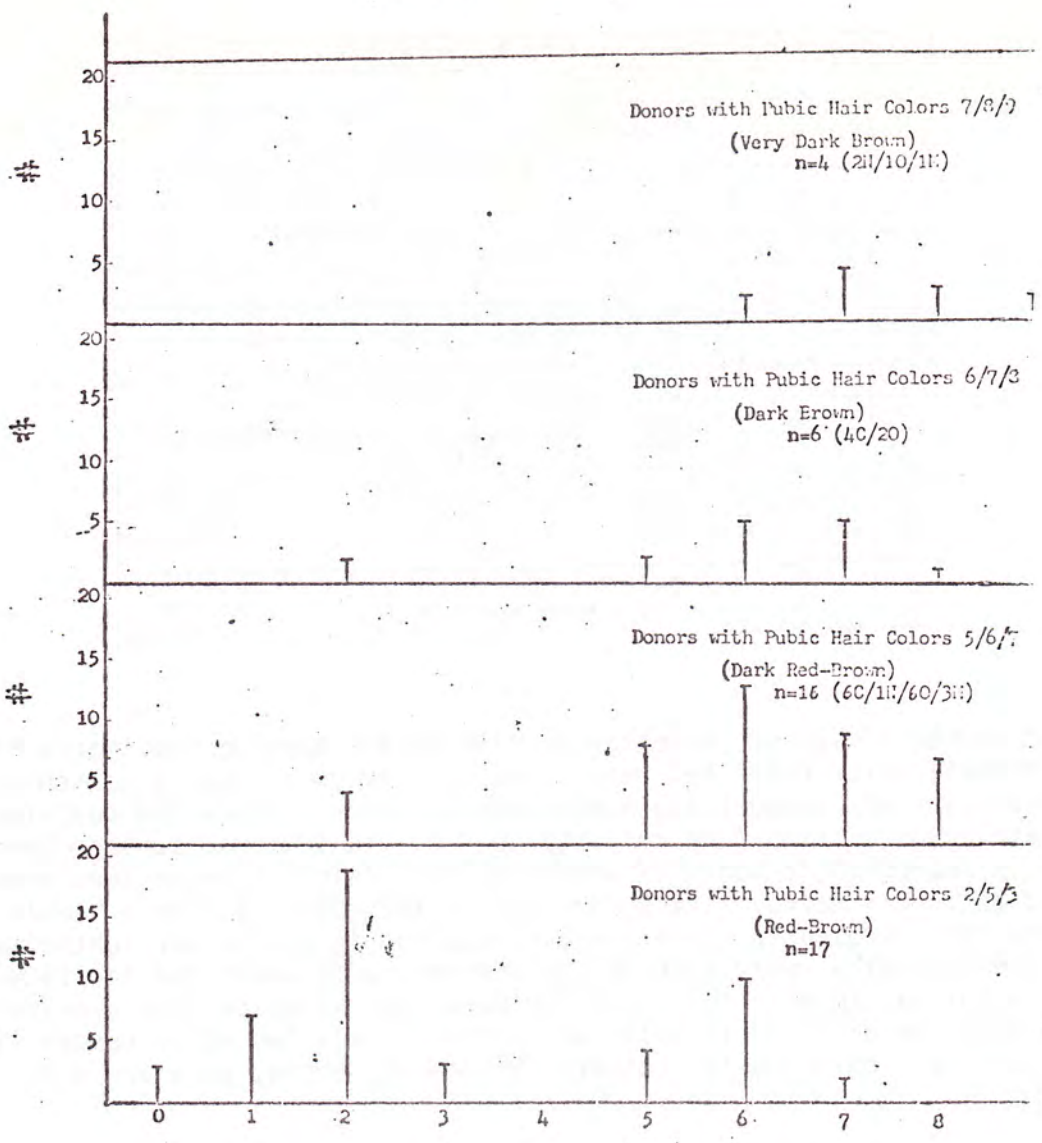
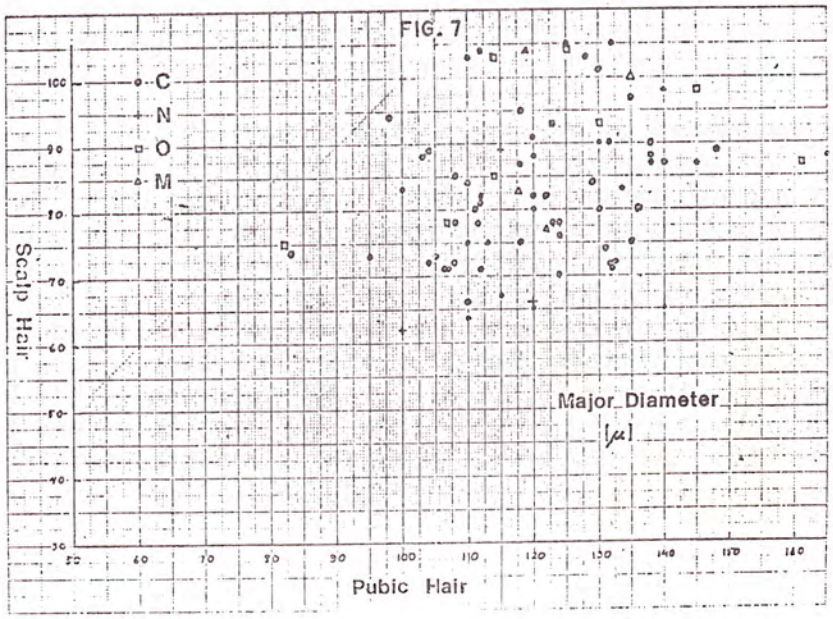
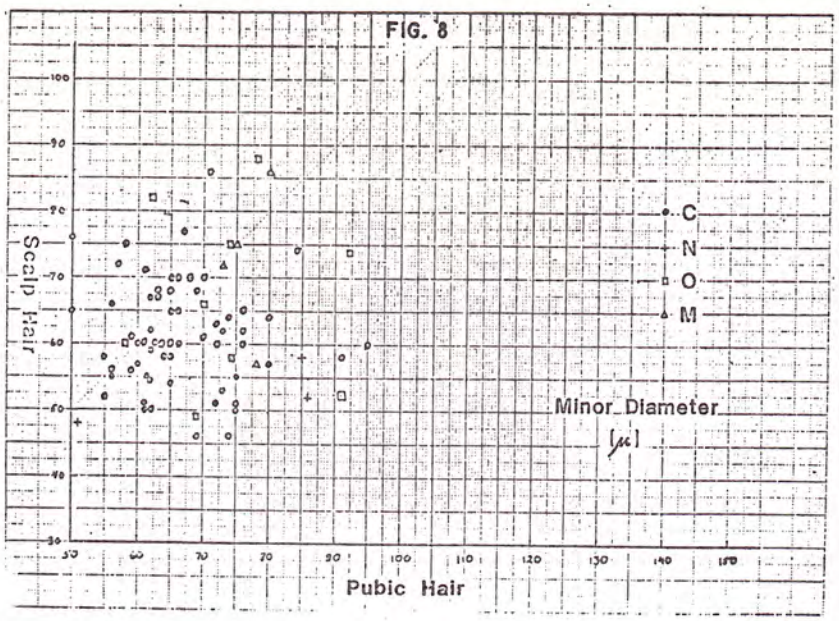

Donors with Pubic Hair Colors 7/8/9
(Very Dark Brown)
n=4 (2M/10/1M)
Donors with Pubic Hair Colors 6/7/8
(Dark Brown)
n=6 (4C/2O)
Donors with Pubic Hair Colors 5/6/7
(Dark Red-Brown)
n=16 (6C/1M/6O/3M)
Donors with Pubic Hair Colors 2/5/5
(Red-Brown)
n=17
#
20
15
10
5
0
1
2
3
4
5
6
7
8
Scalp Hair Color

FIG. 7


C
N
O
M
Scalp Hair
Major Diameter
(μ)
Pubic Hair



Summary:

The use of narrow strips of photographic film slides bearing the images of selected Munsell color chips has been found to provide a simple, convenient, and inexpensive means of categorizing human hair by color. Since the contributions to bulk hair color arising from reflectance from the textured surface have been minimized, a reproducible means of comparing hair colors between specimens can be applied to single hairs. The estimation of the color of a bulk sample (entire scalp) from the microscopic color characterization is not so straightforward, however. In virtually every case in the present study where the identity (and thereby the bulk scalp hair color) of the donor was known to this examiner, it was found that the microscopic color was approximately two color ranges lighter than the bulk hair color would indicate (blonde vs. brown, dark brown vs. black, etc).

Based upon the correlation between scalp hair colors and pubic hair colors, the examiner of an adequate pubic hair specimen can predict the color range that the scalp hair would occupy under microscopic observation. Projection of this color to overall scalp color, would be possible only by considerable experience on the part of the examiner in correlating the physical description of known subjects with the appearance of their hair under the microscope.

Based upon the occurrence of very dark (7-8-9) pubic hairs, it would appear at this time that a non-Caucasian donor was responsible. This racial correspondence awaits a larger representative population for confirmation. Similarly the occurrence of nearly straight or loosely waved (classes 1-2) pubic hairs seems to occur largely in individuals of Oriental extraction. The occurrence of curly or very tightly waved (4-5) pubic hairs appears to be linked to Negro ancestry. The frequency with which inter-racial variants are established in the U.S. should preclude any absolutely certain identifications. Redken Laboratories reports that, in the analysis of over 40,000 scalp hair specimens, they have yet to see an American Negro scalp having purely Negro characteristics and that all their black clients to date have had some Caucasian hair characteristics present.

The diameters, both major and minor, of pubic and scalp hairs do not appear to be dependent upon each other or directly upon any racial type. Once again, this may be due to inter-racial or inter-ethnic breeding. Pubic hair was found to exhibit wide variations in diameter on most individuals; an average measurement range of ± 20μ was not unusual. The range of measurements for scalp hair diameters was on the order of ± 5-10μ for most individuals. The classical morphological features of human pubic hair - coarseness, flatness and kinkiness (by frequent changes in diameter) were present, in greater or lesser degree, in all pubic hair specimens to date, and were not duplicated in any of the scalp hair specimens.

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Some Comments on Refractive Index Measurements

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(Exerpted from the DOJ Tie-Line by permission)

We occasionally learn that some crime labs are apparently still using the Cargile liquids routinely. This is surprising considering the demonstrated variability of these products and their apparent toxicity. The DC710 silicone immersion oil which DOJ purchased in bulk and then had certified by NBS has now been in use in our laboratories for more than two years. DC710 is nontoxic and apparently quite stable but does have the problem of a fairly high refractive index which does not permit the determination of refractive indices much below 1.51. To counter this problem, I have investigated the possibility of blending other DC silicone oils with DC710 and have come up with the information on the following pages. As you will note, DC710 has an n_D of 1.533 at 25°C, whereas DC550 has an n_D of 1.460 at 25°C. Note that the viscosity of the of the 550 and 556 oils is considerably lower than the 710. I think either of these would be of value in reducing the refractive index of DC710 by blending. Note that such blending would, of course, reduce the viscosity of the 710 slightly but a reduction of the viscosity would not be terribly objectionable because it would probably result in better wetting of the particles.

DC550 has been recommended in the past as an immersion oil for refractive index measurement, however, no information is available as to the linearity with regards to temperature of 550 alone or in combination with DC710. As a result, any forensic work involving such a mixture would have to be strictly comparative in the absence of appropriate refractive index standards.

K. P. Anderson, Inc. of Sunnyvale, is the West Coast repackager for Dow Corning silicone oils. They may be contacted at 1-800-672-1858. As of January 1981, their prices for small quantities were as follows:

Oil	Pint	Gallon
DC710	$35.00	$193.50
DC550	31.00	179.00
DC556	16.50	95.00

These are all phenylmethyl silicones and thus are compatible with one another in blending. The DC200 fluids (used as stationary phase in GC work) are dimethyl siloxane polymers and are not compatible with the methylphenyl silicones; therefore, cannot be blended to change refractive indices.

A suitable collection of refractive index standard glasses has been conspicuous in its absence over the past few years. Only Schott Optical Glass Company of Germany has been providing any kind of references and these have been very costly and difficult to come by. There is a new set of reference glass samples in powder form now being offered by Locke Scientific of Basingstoke, England. These kits contain samples of crushed or powdered glass of each refractive index in approximately 2.5g quantities. The cost is on the order of $300 for the set.