Careers in Forensic Science

Anjali R. Swienton, M.F.S., J.D.
President & CEO
SciLawForensics, Ltd.

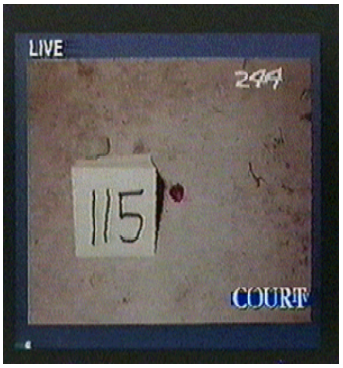
My Career Path…

- BA Molecular Biology The Johns Hopkins University
- MFS The George Washington University
  - Started as lab assistant at Cellmark Diagnostics
- Worked up to Paternity Analyst, then Forensic Analyst

My path continued…

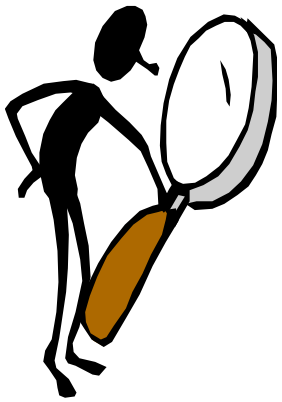
- Went to NIJ/USDOJ Investigative and Forensic Sciences Division
  - Returned to school to get JD at American University
- Started SciLawForensics, Ltd in 2002
- Now consult as a trainer and subject matter expert in DNA, computer crime, general forensics and legal issues

Importance of Forensic Evidence



- An extremely strong link between the victim and suspect
- Correct scientific evidence is extremely difficult to dispute by the defense
- It may help not only the immediate case, but other possible connected cases

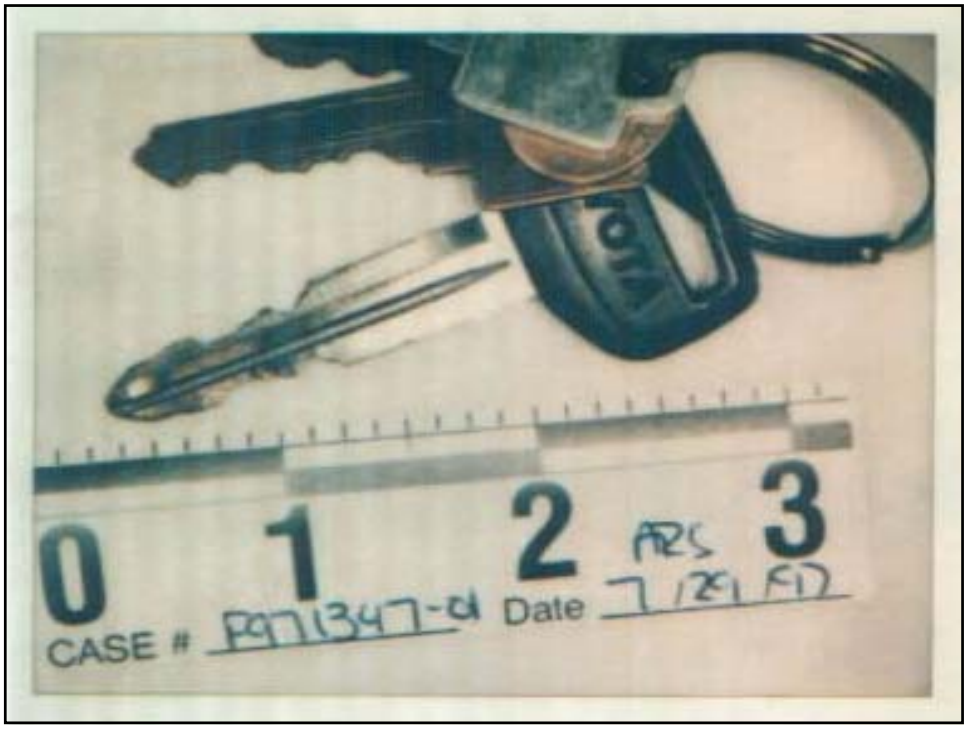
Importance of Proper Collection



- Prevents loss of evidence
- Prevents contamination of the evidence
- Provides documentation to support testimony in a court of law

Case Example

- Female jogger attacked and killed on the trail
- LE thought maybe she had fought attacker with her only weapon - her keys
- Lots of blood on the scene
- Importance of reconstructing the crime and prioritizing probative evidence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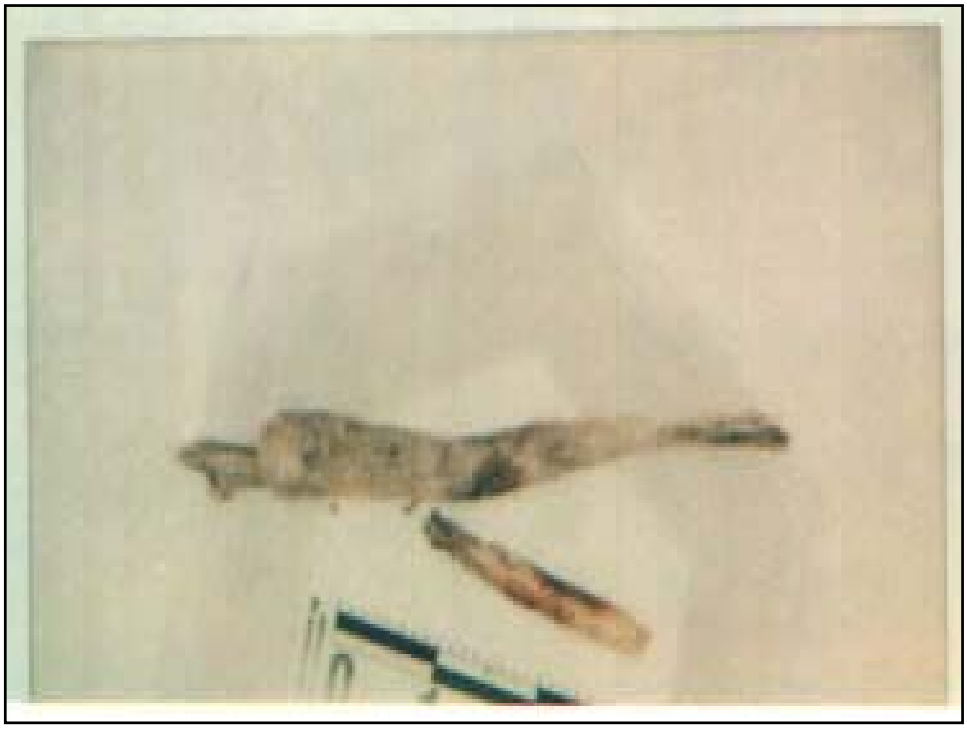
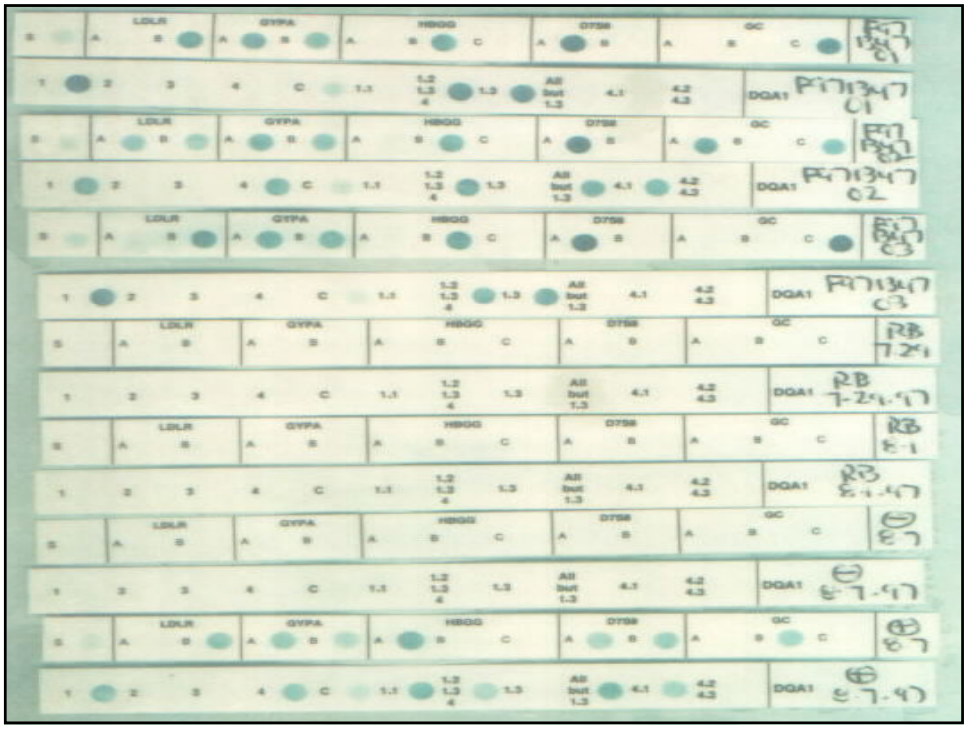
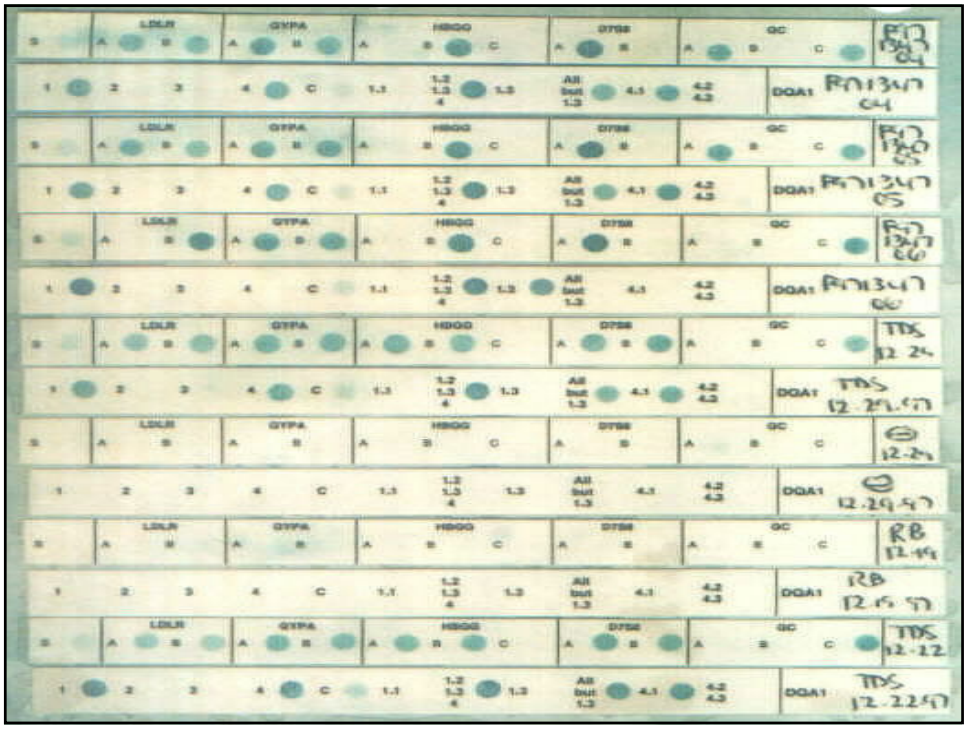


Evidence

- 01 – Victim's keys
- 02 – Blood on leaf
- 03 – Blood on stick
- 04 – Blood on stick
- 05 – Victim
- 06 – Suspect

What results would you expect?





	LDLR	GYPA	HBGG	D7S8	GC	DQA1
01 Keys	**B**	**AB**	**B**	**A**	**C**	**1.2, 1.3**
02 Blood on Leaf	*AB*	*AB*	*B*	*A*	*AC*	*1.2, 4.1*
03 Blood on stick	**B**	**AB**	**B**	**A**	**C**	**1.2, 1.3**
04 Blood on stick	*AB*	*AB*	*B*	*A*	*AC*	*1.2, 4.1*
05 Victim	*AB*	*AB*	*B*	*A*	*AC*	*1.2, 4.1*
06 Suspect	**B**	**AB**	**B**	**A**	**C**	**1.2, 1.3**

DNA/CSI Quiz

True or false:

- DNA results take 8 minutes
- DNA results can tell investigators what a suspect looks like
- DNA results can determine guilt or innocence
- CSIs are all ridiculously good looking and solve crimes wearing Armani
- All CSI drive Hummers, especially in Florida

Myth vs. Reality

CSI:
State of the art equip
Unrealistic turn around times
Unlimited staff
All crimes solved in 42 mins

CSI Effect

Pro:

Increased public awareness and interest in forensic science

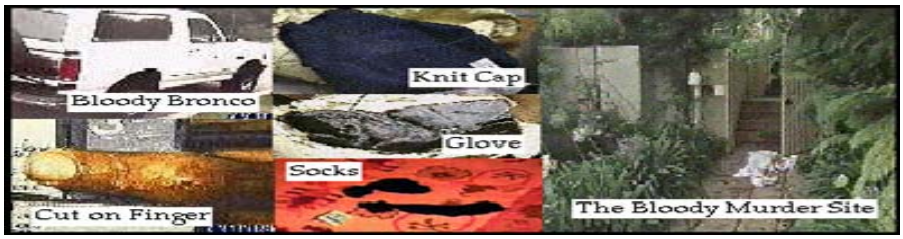
Con:

Unrealistic juror expectations of what forensic science can do

Increased Media Coverage of Forensic Science

- The 3 CSI programs are the top 3 rated shows on TV
- Increase in shows highlighting forensic science
- Even traditional police dramas and movies incorporate forensics into their story lines

Authentication



How do you prove that the DNA detected and reported *actually* came from the event in question and was not planted, fabricated or misinterpreted by the analyst?

Student interest has never been higher

- 20 years ago there were only a handful of forensic science programs
- In the last few years, due to increased student demand, additional programs are starting across the country at numerous universities
- Most programs receive markedly more applications each year than spots their programs can accommodate

Perception vs Reality

- Increased interest could be due in part to glamorized popular media coverage of forensic science
- Reality is much more routine although the impact is enormous
- Lab work may not be as glamorous as what we see on tv, but playing a part in solving crimes and helping victims is immeasurable

A personal story

- Helped develop a training pamphlet for law enforcement on identifying DNA
- Best friend from law school was a cop
- Gave him a pamphlet
- 2 years later he told me that thanks to the pamphlet, he had collected a baseball cap from a rape scene, and six months later, the VA DPS got a hit from the cap!

Forensic Science Programs

To ensure that the quality of these programs meets the hiring requirements of the end users (lab directors), an assessment of status and needs was conducted and published in 1999

TWGED and FEPAC

- Forensic science UG and Graduate curricula recommendations (TWGED)
- Forensic science UG and Graduate accreditation standards (FEPAC – sub committee of AAFS)
  - All accredited institutions listed on FEPAC portion of AAFS website
  - For students interested in careers in forensic science, schools and employers

TWGED
Intro Statement

- Need for foundational science
- Trend towards BA degree
- Supplement science foundation with forensic training or graduate work

Personal Characteristics

- Personal honesty
- Integrity
- Scientific objectivity
- Background checks
- Drug testing
- Polygraphy

Qualifications

- Academic
  - Strong fundamental background in science
- Professional
  - Academic degree in natural science
  - Knowledge, skills, and abilities relevant to the job
  - Demonstrated practical competency and experience in forensic specialty

Skills essential to an individual's effectiveness as a forensic science professional include:

- Critical thinking (quantitative reasoning and problem-solving)
- Decision-making
- Good laboratory technique practices
- Awareness of laboratory safety
- Observation and attention to detail
- Computer proficiency
- Interpersonal skills
- Public speaking
- Oral and written communication
- Time management
- Prioritization of tasks

TWGED
Undergraduate Degree

- Strong and credible science foundation
- Emphasize the scientific method and problem-solving skills
- Knowledge, skills, and abilities including scientific writing, public speaking, laboratory safety practices, computer software application skills, and laboratory skills

The strengths of a model undergraduate forensic science degree include

- Preparation for becoming a forensic science professional.
- Opportunity to establish a network of forensic science contacts.
- An educational background directly linked to the work in a forensic science laboratory.
- Exposure to the breadth of forensic science disciplines.
- Acculturation into the forensic science and criminal justice communities
- Provision of a foundation for professional certification.
- Emphasis to a wide range of courses (e.g., public speaking, ethics, and statistics) that may not be required in the curricula of other natural science majors

TWGED
Undergraduate Degree

- ***Natural Science Core***
- *Minimum general core requirements for all undergraduate forensic science programs (34–38 total credit hours):*
- General chemistry I & II and+ lab for science majors (8 credit hours)
- Organic chemistry I & II and+ lab (8 credit hours)
- Biology I & II for science majors (4-84 credit hours)[1]
- Physics I & II + lab for science majors and lab (8 credit hours)
- Calculus (3 credit hours)
- Statistics for science majors (3 credit hours)
- [1] Classes with laboratory components are preferable, if available.

TWGED
Undergraduate Degree

- In addition to a strong foundation in the natural sciences, forensic science professionals must be aware of certain concepts central to forensic science. Concepts such as individualization, reconstruction, association, and chain of custody of evidence are integral to the field of forensic science. Because the work product of a forensic scientist is used by the justice system, it must meet legal as well as scientific standards

TWGED
Graduate Degree

- The following topics must be included in the graduate forensic science curriculum
  - Crime scenes
  - Physical evidence concepts.
  - Law/science interface.
  - Ethics and professional responsibilities.
  - Quality assurance systems

TWGED
Graduate Degree

- Specific course(s) covering the following topic areas:
  - Analytical chemistry and instrumental methods of analysis.
  - Drug chemistry/toxicology.
  - Microscopy and materials analysis.
  - Forensic biology.
  - Pattern evidence.

TWGED
Research Component

- Critical to elevating the rigor of a graduate program
- Requires using advanced concepts and variety of experimental techniques and instruments
- Contributes to the body of knowledge and elevates status of the profession

TWGED
Laboratory Component

- Gives practical hands-on experience which prepares students to:
  - Plan and execute experiments
  - Anticipate, recognize, and respond properly to chemical and biological hazards.
  - Keep legible and complete laboratory records.
  - Conduct qualitative and quantitative analyses.
  - Use and understand instrumentation and fundamental techniques.
  - Analyze data and evaluate experimental results.
  - Assess reliability of results and draw reasonable conclusions.
  - Communicate effectively through oral and written reports.

TWGED Accreditation

- Currently no mechanism for the accreditation of forensic science graduate programs. When such a process is implemented, it is strongly recommended that all such programs seek accreditation.
- Benefits of accreditation include
  - An external means of validation of the program.
  - A valuable tool to help students select a program.
  - A means for forensic scientists and potential employers to judge the credentials of graduates.
  - Improvement of program quality.
  - A high level of competency for the graduates.

What Lab Directors Want

- Employees with a strong science background
- Problem solving skills
- Public speaking
- Report writing skills

What Lab Directors Want (cont'd)

- Evidence handling and testimony could be trained on the job, but a strong science foundation was critical
- Accreditation requirements dictate in some disciplines that analysts train for a certain amount of time before working on real case work, but coming to the lab with internship or other hands-on experience was a plus

Quality of Existing Programs

- Lab directors found that many of the existing programs did not adequately prepare their employees for a career in a forensic laboratory
- Several programs were really just criminalistics degrees disguised as forensic science, with little or no actual science requirements

The Solution

- TWGED – the Technical Working Group on Education and Training in Forensic Science
- Supported by the National Institute of Justice (NIJ) and ran by the West Virginia University, Forensic Science Initiative

TWGED (cont'd)

- Comprised of ~40 forensic science educators and laboratory directors
- Recommended minimum standards for undergraduate and graduate forensic science degree and certificate programs
- First time standardization for forensic science was attempted

FEPAC

- Forensic Science Education Programs Accreditation Commission
- Committee of the AAFS
- Developed accreditation standards based on TWGED guidelines
- Currently in the third year of full accreditation

FEPAC Standards

- Proscribe curriculum requirements for both undergraduate and graduate forensic science degree and certificate programs
- Accreditation is voluntary
- Provides gauge for interested students applying to programs and for lab directors hiring those students
- Accredited programs will be listed on the AAFS website

FEPAC standards

- Undergrad:
  - Specific science courses
  - Forensic science courses
  - Forensic science topics
- Graduate:
  - Seminar
  - Research

Sample FEPAC undergrad standards

4.3.2.1. <u>Natural Science Core Courses</u>

- Biology: at least one course, which includes an associated laboratory, in biology for science majors (4 semester hours).
- Physics: at least two courses, each of which includes an associated laboratory, in physics for science majors (8 semester hours). Note: Calculus-based physics is preferred but not required.
- Chemistry: at least four courses, each of which includes an associated laboratory. Two of the courses shall be in general chemistry for science majors (8 semester hours), and two shall be in organic chemistry for science majors (8 semester hours).
- Mathematics: at least one course in differential and integral calculus (3 semester hours) and at least one course in statistics (3 semester hours).

FEPAC undergrad standards (cont'd)

4.3.2.2. <u>Specialized Science Courses</u>

- A minimum of 12 additional semester hours in more advanced coursework in chemistry or biology. Note: These classes shall be consistent with the degree program and shall meet the needs of students specializing in subdisciplines of forensic science. At least two of the classes shall include laboratory training.
- A suggested list of classes that satisfy this requirement may be found in the TWGED report.

FEPAC undergrad standards (cont'd)

4.3.2.3. <u>Forensic Science Courses</u>

- A minimum of 15 semester hours in forensic science coursework that covers the following topics: courtroom testimony; introduction to law; quality assurance; ethics, professional practice, background; evidence identification, collection, processing; and a survey of forensic science.
- Of these 15 hours, 9 semester hours shall involve classes in forensic chemistry, forensic biology, physical methods, or microscopy that contain a laboratory component. Internships or independent study/research courses may be used to fulfill up to 6 hours of this laboratory requirement.

FEPAC standards Graduate

5.3.2.1 Core Forensic Science Topics

- Crime scene investigation
- Physical evidence concepts
- Law/science interface
- Ethics and professional responsibilities
- Quality assurance
- Specific courses covering the following areas:
- Analytical chemistry and instrumental methods of analysis
- Drug chemistry/toxicology
- Microscopy and materials analysis
- Forensic biology
- Pattern evidence

FEPAC graduate standards (cont'd)

5.3.2.2 Courses in Specialized Areas

- Graduate-level science courses appropriate to the specialization, track(s), and/or concentration(s) offered by that institution, e.g., molecular biology and population genetics, advanced analytical chemistry, and materials analysis.

5.3.2.3 Graduate Seminar

- A seminar presented by experts and students on original research and other relevant topics.

FEPAC graduate standards (cont'd)

5.3.2.4 Research

- Completion by each student of an independent research project. The research project shall culminate in a thesis or written report. In addition, the results of the work shall be presented orally in a public forum for evaluation.
- The research shall be conducted in an environment conducive to research and scholarly inquiry, and shall provide the opportunity for faculty and students to contribute to the knowledge base of forensic science, including research directed at improving the practice of forensic science.

FEPAC standards

Draft of TWGED guidelines and FEPAC standards can be found at:

- www.aafs.org

FEPAC Accredited Programs

- **Arcadia University**
- **Cedar Crest College**
- **Eastern Kentucky University**
- **Florida International University**
- **Marshall University**
- **Metropolitan State College of Denver**
- **Michigan State University**
- **Ohio University**
- **Virginia Commonwealth University**
- **West Chester University**
- **West Virginia University**

Pursuit of Justice

- Better educated students make better laboratory employees
- Better lab analysts = more assistance to law enforcement and the judiciary in solving and prosecuting crimes, as well as better protection of the innocent

Forensic Science Careers

- Traditional:
  - Federal, state and local crime labs
  - Specialized labs
- DNA, toxicology, hairs and fibers, latent prints, questioned documents, fire/arson, pattern matching, etc.

Forensic Science Careers

- Non-traditional:
  - Forensic psychiatry
  - Pathology
  - Odontology
  - Entomology
  - Engineering
  - Nursing
  - Anthropology
  - Computer Forensics

The National Clearinghouse for Science, Technology and the Law

Assemble scientific, technological and relevant legal authority in one resource with access for all

30 Topics Being Researched

- Biometrics – body scans, facial recognition and retinal scans
- Bloodstain Pattern Analysis
- Crime Laboratories
- Digital Evidence
- Digital Image Enhancement
- DNA
- Entomology
- Expert Witness Malpractice
- Fingerprints
- Firearms/Tool Marks
- Forensic Accounting
- Forensic Anthropology
- Forensic Linguistics
- Forensic Odontology
- Forensic Pathology
- Forensic Psychology
- Locating, Selecting and Evaluating Experts
- Professional Associations, Board Certifying Bodies and Institutes
- Questioned Documents
- Smart Cards
- Thermal Imaging
- Toxicology
- Trace Evidence – Fibers, Glass, Hair, Paint
- Voice Analysis

Information Available for Each Topic

- Board certifying bodies
- Books, Encyclopedias and Treatises
- Cases
- College and University Courses
- Commercial Applications of Science/Technology
- Conference Proceedings and Abstracts
- Continuing Education Courses
- Dissertations
- Internet Articles
- Law Reviews and Bar Journals
- Legislation
- Newspapers, Magazines and Periodicals
- Radio/Television Shows
- Scientific Journals
- SWGs and TWGs
- Web Sites

Scientific Working Groups

www.for-swg.org/index.htm

- SWGDAM
  - DNA analysis methods
- SWGDE
  - Digital evidence
- SWGDOC
  - Document examination
- SWGFAST
  - Friction ridge analysis/fingerprinting
- SWGSTAIN
  - Bloodstain pattern
- SWGGUN
  - Firearms & Tool marks
- SWGIT
  - Imaging technologies
- SWGMAT
  -Trace
- SWGFAX
  -Xray spectra
- SWGDRUG
  -Drug analysis

Technical Working Groups

TWGs produced publications on:

- Crime Scene Evidence
- Fire and Arson
- Explosion and Bombing
- Eyewitness Evidence
- Digital Evidence (6 volume series)
- Forensic Science Education

Organizations and other references

- AAFS
- IAI
- AAAS
- NAS
- NDAA
- ABA
- OVC
- OJP
- Westlaw
- LEXIS/NEXIS
- MAAFS
- MWAFS
- SWAFS
- NEAFS
- NWAFS
- SAFS

Useful References

NIJ:
http://nij.ncjrs.org/publications/pubs_db.asp
DNA Commission
http://www.ojp.usdoj.gov/nij/topics/forensics/dna/commission/welcome.html
DNA.GOV
http://dna.gov/
NIST
http://www.cstl.nist.gov/div831/strbase/
NCSTL
http://www.ncstl.org/

Internship Opportunities

Medical Examiners' Offices
AFDIL
Commercial Labs
DOJ/NIJ
FBI
NIST
John Butler - (301) 975-4049
john.butler@nist.gov

THANK YOU!!

Any questions?

Contact:
Anjali R. Swienton
President & CEO
SciLawForensics, Ltd.
301-528-5050
aswienton@scilawforensics.Com
www.scilawforensics.com