

UT Environmental Science Institute

# 35

#### CSI – Texas: The Science of Sleuthing

#### William L. Ginn March 11, 2005

Produced by and for *Hot Science - Cool Talks* by the Environmental Science Institute. We request that the use of these materials include an acknowledgement of the presenter and *Hot Science - Cool Talks* by the Environmental Science Institute at UT Austin. We hope you find these materials educational and enjoyable.

#### **Texas Department of Public Safety**



#### Crime Laboratory Service William L. Ginn, Manager-Headquarters Lab



#### World

#### THE CAPTURE OF AMERICA'S MOST WANTED

HOW MEXICO NABBED A NOTORIOUS DRUGLORD--AND SHIPPED HIM TO A U.S. JAIL By <u>KEVIN FEDARKO</u>

#### Jan. 29, 1996

IN THE TOWN OF VILLA JUAREZ, just south of Monterrey, 15 Mexican drug agents spent most of Jan. 14 crouched outside a walled ranch house. The agents had received a critical tip: Juan Garcia Abrego, one of Mexico's most powerful drug dealers, was inside. At 7 p.m., the team moved in. They smashed through the front gate in a minivan, taking Garcia Abrego and two bodyguards by surprise. As the druglord dashed out a back door and tried to launch his portly frame over a fence, agents grabbed him by the shirt. Twenty minutes later, the man who had shipped perhaps a third of the cocaine consumed in the U.S....



#### Juvenile Murdered by Neighbor

#### **AMERICAN ATHEISTS**

email: info@atheists.org

#### The Murray O'Hair Family

#### FEDERAL AUTHORITIES CONFIRM REMAINS OF MURDERED O'HAIR FAMILY

TIMELY, FREE E-MRIL NEWSLETTER FROM AMERICAN ATHEISTS

March 15, 2001

#### Austin American-Statesman

#### **Scaggs guilty of murder**



Life term possible in slaying of wife

By Lean QUIN American-Statesman Staf

Moments after a Travis County jury found him guilty of murdering his wife, Roger Scaggs embraced his daughter, Sarah Scaggs, laying his head on her shoulder in a gesture of grief that prosecutors said he



the software executive and former S u n d a y s c h o o l t e a c h e r bludgeoned 1996

Software executive Roger Scaggs and his daughter, Sarah home. Sarah Scaggs mainta Scaggs, embrace Saturday after a Travis County jury found plans to testify in the punishh im guilty of murdering his wife in March 1996 in their Austin begin Monday. Story, **A13**.

home. Sarah Scaggs maintains her father's innocence. She plans to testify in the punishment phase of the trial, which will begin Monday. **Story, A13.** 

and stabbed P e n n y Scaggs in their home near Barton Creek Square mall on March 6, 1996, They will meet



#### Objectives of the Texas DPS Crime Lab

- Scientific examination and analysis of evidence
- Supervision and management of technical programs
- Assistance in scientific investigations
- Expert testimony



#### **Texas DPS Crime Laboratory System**

- Headquarters and 12
  Field Laboratories
  - Headquarters full service forensic lab
  - Field from drugs only to near full service



#### **Austin Headquarters - Lab Services**

- DNA
- Toxicology
- Controlled Substances
- Forensic Photography
- Trace Evidence
- Firearms

- Combined DNA Index System (CODIS)
- Automated Fingerprint Identification System (AFIS)
- Latent Prints (e.g. fingerprints)
- Questioned Documents



### **Evidence Control**



![](_page_6_Picture_2.jpeg)

# Evidence is stored in controlled access areas under proper seal

![](_page_6_Picture_4.jpeg)

### Latents Prints / Fingerprint ID

A variety of techniques to identify and match prints:

- carbon powder dusting
- super-glue and ninhydrin spray techniques
- amido-black visualization
- argon laser
- AFIS (Automated Fingerprint Identification System): computerized system that stores characteristics of >4.4 million individuals in DPS Crime Records
- AFIS performs computer searches of unknown fingerprints by optically scanning a print and comparing it with those on file

#### **Latent Prints**

Latent Prints Movie 1

#### **Latent Prints**

Latent Prints Movie 2

# Automated Fingerprint Identification System (AFIS)

AFIS Movie

## **DNA (Nuclear)**

![](_page_11_Picture_1.jpeg)

## **DNA Technologies**

#### Restrictive Fragment Length Polymorphism

![](_page_12_Picture_2.jpeg)

#### Polymerase Chain Reaction (PCR) Short Tandem Repeats

![](_page_12_Figure_4.jpeg)

### **How PCR works**

- DNA strand separates when heated (denaturing)
- Primers attach (annealing) when cooled, and enzymes create a complement strand (extension) when warmed
- Cycle is repeated approximately 30 times

![](_page_13_Figure_4.jpeg)

![](_page_13_Picture_5.jpeg)

### **Evidence Screening for Trace and Serological Evidence**

Evidence Screening Movie

# Combined DNA Index System (CODIS)

- Began in Texas in 1995 with House Bill 40
- Currently 130,000 profiles in Texas DNA database (as of 10/04)
- Used to identify suspects in crimes where blood, other bodily fluids, or hair evidence is left by the perpetrator
- Future of CODIS depends on legislative mandate

![](_page_15_Picture_5.jpeg)

![](_page_16_Picture_0.jpeg)

#### National DNA Index System (NDIS) Participants September 2004 - 50 States, US Army, the FBI, and Puerto Rico

![](_page_16_Figure_2.jpeg)

## **Forensic Photography**

- Crime scene photography and reconstruction using specialized forensic photographic techniques (e.g. Luminol for blood visualization)
- Photograph latent prints
- Details of crime scene evidence for presentation in court and for teaching
- Digital Image Enhancement

![](_page_17_Picture_5.jpeg)

Luminol

### **Forensic Firearms**

- Projectile and cartridge case comparisons
- Comparison to other fired cases and projectiles
- Comparison to known weapons
- Determination of caliber and make of unknown weapon
- Ammunition identification
- Distance determination
- Toolmarks
- Obliterated data

![](_page_18_Picture_9.jpeg)

### **Weapon Manufacturing-Barrel**

- A gun barrel is produced by boring a hole down the length of a steel blank
- "Rifling" is imparted to the inside surface of a gun barrel by drawing a broach or button through the bore

![](_page_19_Figure_3.jpeg)

![](_page_19_Picture_4.jpeg)

![](_page_19_Picture_5.jpeg)

![](_page_19_Picture_6.jpeg)

Button

![](_page_19_Picture_8.jpeg)

### **Weapon Manufacturing**

- Rifling gives the projectile gyroscopic stability during flight
- Making a gun barrel produces toolmarks on the inside of the barrel, which are imparted to the projectile during its passage down the bore

![](_page_20_Picture_3.jpeg)

![](_page_20_Picture_4.jpeg)

Cross section of inside of bore after broach has been drawn through

#### Weapon Manufacturing Breech Marks

![](_page_21_Picture_1.jpeg)

**Breech face** 

![](_page_21_Picture_3.jpeg)

Primer area of fired cartridge

### Forces (during gun firing)

19.5

Firing Pin

In cartridge discharges, bullet and Idge case experience opposite forces

Barrel

![](_page_22_Picture_3.jpeg)

Breech Face

### **Through the Microscope**

![](_page_23_Picture_1.jpeg)

Breech marks left on cartridge head during firing

Extractor marks made by auto-loading weapon

#### **Firearms Test Shots**

Firearms Test Movie

# National Integrated Ballistics Imaging Network (NIBIN)

Database of fired cartridge cases and projectiles

- Collection and interagency sharing of forensic data and imagery
- Rapid, comprehensive searching of local and regional firearms evidence files
- Remote electronic comparisons of digital images
- Linking unsolved shootings to other incidents and/or confiscated firearms
- Linking repeat offenders to crimes, and expediting their identification

### National Integrated Ballistics Imaging Network (NIBIN)

NIBIN Movie

### TOOLMARKS

Individualized characteristics of cutting surfaces of tools from their manufacture and use

![](_page_27_Picture_2.jpeg)

![](_page_27_Figure_3.jpeg)

#### **Class characteristics**

![](_page_27_Picture_5.jpeg)

Individual characteristics

### **Questioned Documents**

Examines original handwriting specimens from checks, wills, suicide and threat letters, forgeries, voter fraud, etc.

#### Also examines:

- typewriters (paper fiber transfer, wear patterns, and fracture patterns)
- photocopier and ink comparisons
- fraudulent tickets
- documents
- rubber stamps
- head lamps/turn signals
- trash bag comparisons

#### Computer data recovery

![](_page_28_Picture_11.jpeg)

#### Visual Spectral Comparator (VSC) shows modifications to original document

![](_page_29_Picture_1.jpeg)

### **Latent Writing Impressions**

![](_page_30_Picture_1.jpeg)

**Oblique lighting** 

### **Detection of differences in inks**

![](_page_31_Picture_1.jpeg)

IR Luminescence detects differences in ink chemical composition

![](_page_31_Picture_3.jpeg)

#### **Trace Evidence**

Locard's Exchange Principle: When two objects come into contact there is always transfer of material from one to the other. Such material may be small or large, may be difficult to detect, nevertheless it occurs.

#### **Trace Evidence**

Trace evidence can be used to associate a suspect, victim, weapon and crime scene

![](_page_33_Figure_2.jpeg)

### Trace Evidence Analysis (Criminalistics)

![](_page_34_Picture_1.jpeg)

 Hair, fiber, paint, glass, soil, and gunshot residue from a variety of types of crimes

#### Specialized techniques include:

- polarizing microscopy
- Microspectrophotometry
- X-ray diffraction pattern analysis
- Inductively Coupled Plasma (ICP)

- emission and infrared spectroscopy
- gas chromatography
- refractive index determination

#### **Trace Evidence**

![](_page_35_Picture_1.jpeg)

#### **Caucasian Head Hair**

![](_page_36_Picture_1.jpeg)

#### Discharge of Gunshot Residue by Revolver

![](_page_37_Picture_1.jpeg)

#### Handswab Analysis for Gunshot Residue

# BariumLeadAntimony

Samples from a subject should contain 5 swabs:

- Left and right palms
- Left and right back
- Control

![](_page_38_Picture_6.jpeg)

### **Plastic Trash Bag Comparison**

![](_page_39_Figure_1.jpeg)

Note die lines and "arrowhead" alignment across perforation

### Drug Analysis Analytical Methods

Spot Tests – preliminary only
 Microscopic or microcrystalline
 Thin layer chromatography

- Instrumental Analysis
  - UV-Visible Spectrometry
  - Chromatography
  - Mass Spectrometry
  - FTIR

![](_page_40_Picture_7.jpeg)

### **Automobile Paint**

![](_page_41_Picture_1.jpeg)

Collect known paint sample from damaged area

![](_page_41_Picture_3.jpeg)

# Compare to paint on victim's clothing

#### **Non-Instrumental Tests**

#### **Spot Tests**

![](_page_42_Picture_2.jpeg)

Marquis test for opiates

Scott test for cocaine

#### Microcrystalline Tests

![](_page_42_Picture_6.jpeg)

![](_page_42_Picture_7.jpeg)

### Thin Layer Chromatography

![](_page_43_Figure_1.jpeg)

![](_page_43_Picture_2.jpeg)

Here, marihuana components (THC, Cannibinol, and Cannabidiol) can be visualized using Fast Blue B as a locating reagent

### **Gas Chromatography**

![](_page_44_Figure_1.jpeg)

### **Controlled Substances**

Cocaine

![](_page_45_Picture_2.jpeg)

![](_page_45_Picture_3.jpeg)

Heroin

Marihua<u>na</u>

#### Marihuana Microscopic View

![](_page_46_Picture_1.jpeg)

#### **Glandular hairs**

Cystolithic hairs

![](_page_47_Picture_0.jpeg)

#### Dried Opium Poppy Pods

![](_page_47_Picture_2.jpeg)

![](_page_47_Picture_3.jpeg)

![](_page_47_Picture_4.jpeg)

"Latex" from pod contains opium

### **Stimulants - Methamphetamine**

![](_page_48_Picture_1.jpeg)

Clandestine Meth Labs

![](_page_48_Picture_3.jpeg)

![](_page_48_Picture_4.jpeg)

Finished product

![](_page_48_Picture_6.jpeg)

Waste

![](_page_48_Picture_8.jpeg)

#### Coca Leaves

![](_page_49_Picture_1.jpeg)

#### Cocaine

![](_page_49_Picture_3.jpeg)

#### Cocaine HCI

![](_page_49_Picture_5.jpeg)

#### Kilo of Cocaine HCl

![](_page_49_Picture_7.jpeg)

#### "Crack" Cocaine (base)

![](_page_49_Picture_9.jpeg)

### Hallucinogens & Club Drugs

LSD

![](_page_50_Picture_2.jpeg)

#### Ecstacy (XTC)

![](_page_50_Picture_4.jpeg)

![](_page_50_Picture_5.jpeg)

![](_page_51_Picture_0.jpeg)

# Case of Juan Garcia-Abrego

![](_page_52_Picture_1.jpeg)

![](_page_52_Picture_2.jpeg)

Worl

#### THE CAPTURE OF AMERICA'S MOST WANTED

HOW MEXICO NABBED A NOTORIOUS DRUGLORD--AND SHIPPED HIM TO A U.S. JAIL By KEVIN FEDARKO

#### Jan. 29, 1996

IN THE TOWN OF VILLA JUAREZ, just south of Monterrey, 15 Mexican drug agents spent most of Jan. 14 crouched outside a walled ranch house. The agents had received a critical tip: Juan Garcia Abrego, one of Mexico's most powerful drug dealers, was inside. At 7 p.m., the team moved in. They smashed through the front gate in a minivan, taking Garcia Abrego and two bodyguards by surprise. As the druglord dashed out a back door and tried to launch his portly frame over a fence, agents grabbed him by the shirt. Twenty minutes later, the man who had shipped perhaps a third of the cocaine consumed in the U.S....

> Juan "La Muneca" Garcia-Abrego

![](_page_52_Picture_9.jpeg)

#### **Case of Garcia-Abrego**

![](_page_53_Picture_1.jpeg)

![](_page_53_Picture_2.jpeg)

![](_page_53_Picture_3.jpeg)

### Case of Madalyn Murray-O'Hair

#### **AMERICAN ATHEISTS**

email: info@atheists.org

The Murray O'Hair Family

FEDERAL AUTHORITIES CONFIRM REMAINS OF MURDERED O'HAIR FAMILY TIMELY, FREE E-MAIL NEWSLETTER FROM AMERICAN ATHEISTS

March 15, 2001

![](_page_54_Picture_7.jpeg)

![](_page_54_Picture_8.jpeg)

## Case of Madalyn Murray-O'Hair

#### O'Hare hip with serial number

![](_page_55_Picture_2.jpeg)

![](_page_55_Picture_3.jpeg)

### **Juvenile Murder Case**

![](_page_56_Picture_1.jpeg)

![](_page_56_Picture_2.jpeg)

#### Juvenile Murdered by Neighbor

![](_page_56_Picture_4.jpeg)

![](_page_56_Picture_5.jpeg)

### **Juvenile Murder Case**

 Paint chip found on victim's body matched detect in wall (caused by serrated knife blade)

### **Juvenile Murder Case**

![](_page_58_Picture_1.jpeg)

# **Case of Roger Scaggs**

#### Austin American-Statesman **Scaggs guilty of murder**

![](_page_59_Picture_2.jpeg)

Life term possible in slaying of wife

BY LEAH OUIN American-Statesman Staff

Moments after a Travis County jury found him guilty of murdering his wife, Roger Scaggs embraced his daughter Sarah Scaggs, laying his head on her shoulder in a gesture of grief that prosecutors said he never dis-

played after the death of his wife of 35 Jurors deliberated 8½ hours before deciding Saturday that the software

![](_page_59_Picture_7.jpeg)

Penny Scaggs in their home near Barton Creek Square mall on

![](_page_59_Picture_9.jpeg)

Scaggs, embrace Saturday after a Travis County jury found plans to testify in the punishment phase of the trial, which will him guilty of murdering his wife in March 1996 in their Austin begin Monday. Story, A13.

Software executive Roger Scaggs and his daughter, Sarah home. Sarah Scaggs maintains her father's innocence. She

Victim's blood on outside of glove

![](_page_60_Picture_1.jpeg)

#### Suspect's print on inside of glove

#### **Case of Roger Scaggs**

![](_page_60_Picture_4.jpeg)

#### **Texas Department of Public Safety**

![](_page_61_Picture_1.jpeg)

Crime Laboratory Service William L. Ginn, Manager-Headquarters Lab

### William Ginn

![](_page_62_Picture_1.jpeg)

William Ginn earned a Bachelor of Science in Chemistry from The University of Texas at Austin in 1971 and began his career with the Texas Air Control Board (now part of the Texas Commission on Environmental Quality) as a chemist from 1971-1973. He was responsible for the development and validation of wet chemical methods for the analysis for gaseous air pollutants. He then went to work for the Texas Department of Public Safety's (DPS) Crime Laboratory in 1973, where he received training at the Headquarters Lab in various areas of forensic analysis, including drugs, trace, serology, blood alcohol, and firearms and was then transferred to the Garland field laboratory. At that time, many forensic analysts were "generalists" and did not specialize in any particular area.

In 1984, Ginn became the Supervising Criminalist for the Headquarters laboratory's drug analysis section, where he was responsible for section operations, analysis of evidence, clandestine laboratory processing, training new analysts, and providing instruction to police officers. During his 18-year period as a bench analyst and section supervisor, he has provided testimony in County, State, and Federal courts both within and outside Texas over 800 times.

In 1991, Ginn became the Assistant Manager of the DPS Field Laboratories where I was responsible for the operations of 12 crime laboratories. In 2000, he became the Manager of the Headquarters Crime Laboratory, where he supervises approximately 70 forensic scientists. In addition to his responsibilities at the Department, he also serves as a volunteer inspector for the American Society of Crime Laboratory Directors/Laboratory Accreditation Board, the nation's largest forensic laboratory accrediting body.