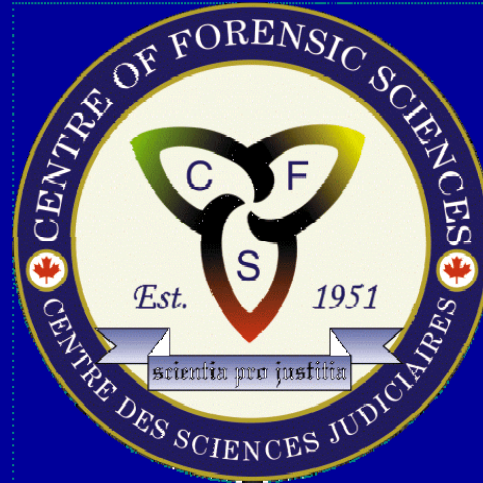


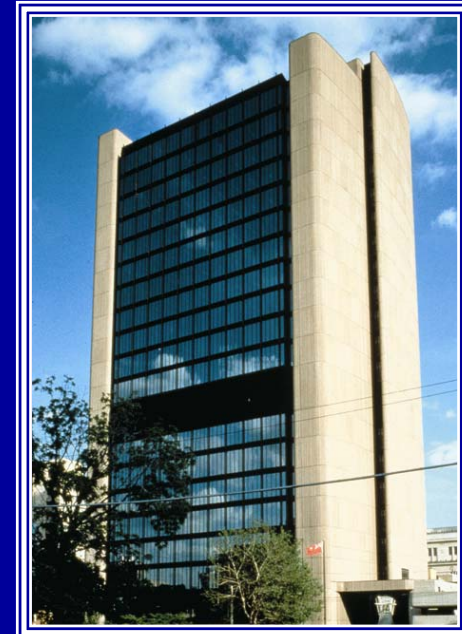
The Centre of Forensic Sciences



Ontario Justice Education Network Summer Law Institute
August 26, 2008

Kimberley Johnston, (A) Organizational Development
Section Head

Centre of Forensic Sciences



Who We Are

- A forensic or “crime” laboratory
 - *Forensic science* is the application of science to questions which are of interest to the legal system
- A branch within the Public Safety Division of the Ministry of Community Safety and Correctional Services
- A Government of Ontario analytical laboratory
- 1st accredited Canadian forensic laboratory

Purpose

We will support the justice system and enhance public safety by:

- performing relevant scientific tests
- providing education and training
- provide scientific expertise
- conducting research, and
- producing reports and testimony that are:
 - ❖ understandable
 - ❖ objective
 - ❖ accurate, and
 - ❖ timely

within the scope of government policy and resource availability,
and respecting the needs of staff and clients.

CFS Clients

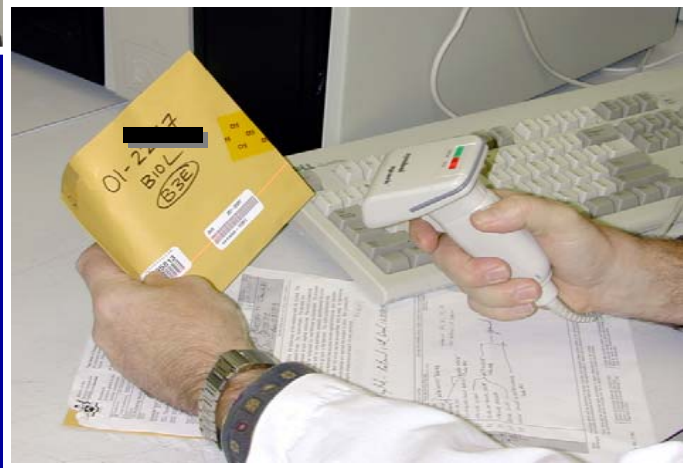
- Police
 - Other investigators (e.g., Office of the Fire Marshal, Special Investigations Unit, conservation officers, Ministry of Labour, Ministry of the Environment)
 - Coroners and pathologists
 - Crown and defence counsel
-
- Most of CFS' casework consists of criminal and coroners' cases

Locard's Exchange Principle

When any two objects come into contact, there is always a transference of material from each object onto the other.

Edmond Locard ca. 1928

Centre Receiving Office



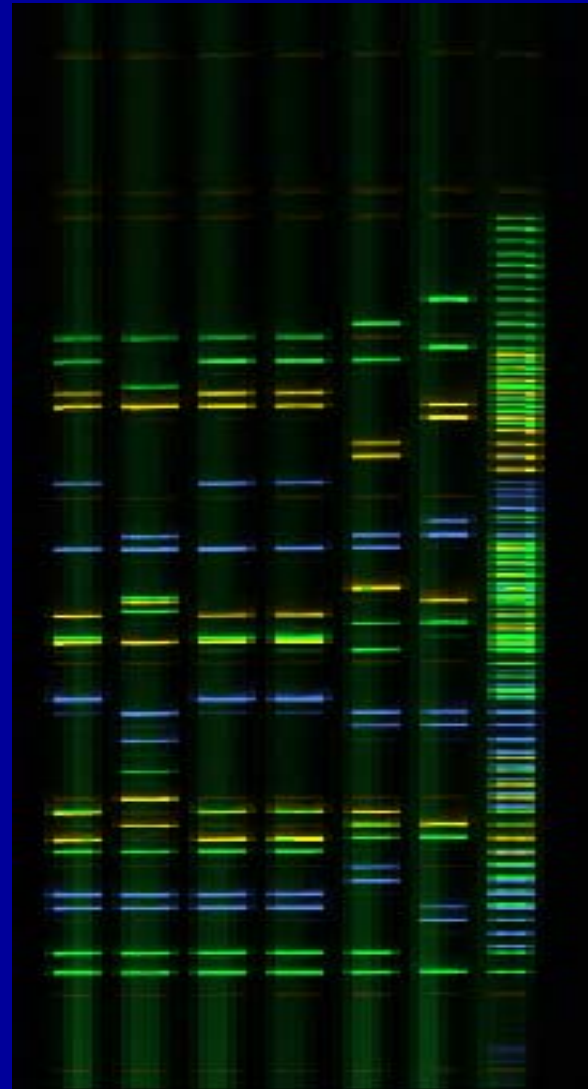
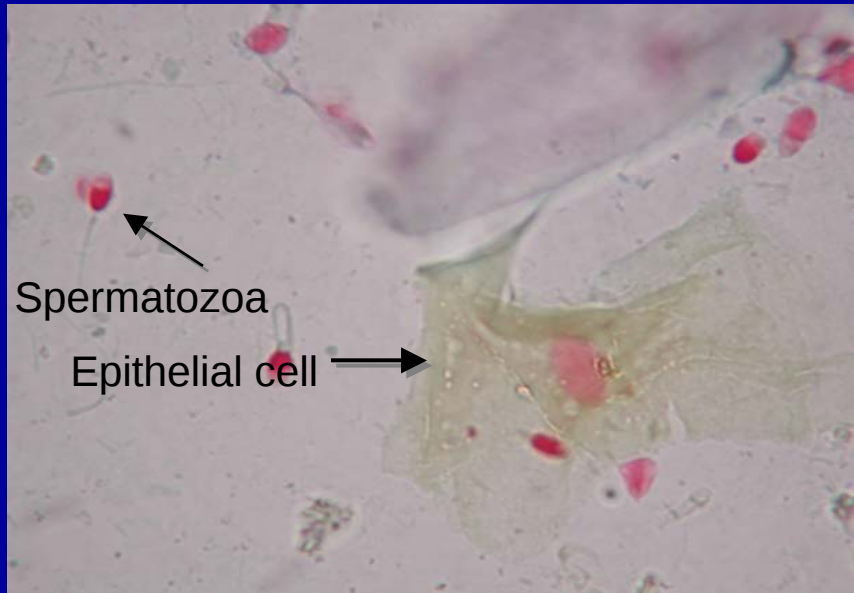
Centre Receiving Office

- All items submitted through CRO; first link in chain of custody (continuity)
- Items identified, entered into the Laboratory Information Management System and barcoded, then sent to relevant section(s) for storage under proper conditions
- Criteria for case acceptance
 - The analysis requested must fall within one of the Centre's scientific disciplines
 - A validated, authorized procedure must be in place
 - The Items should have been properly collected, packaged and stored prior to arrival at CFS
 - There must be sufficient time available to do the requested work
 - Only items relevant to the investigation and suitable for forensic examination will be accepted

Biology

- Body fluid identification
- DNA profiling
- Bloodstain pattern interpretation
- Hairs & fibres
 - Fabric damage assessment
- Counter terrorism initiative:
identification of victims of mass disaster

Body Fluid Identification & DNA Profiling



D18S51

D7S8

20

FGA

D13S317

D21S11

vWA

D5S818

D8S1179

D3S1358

AMELOGENIN



Bloodstain Pattern Analysis



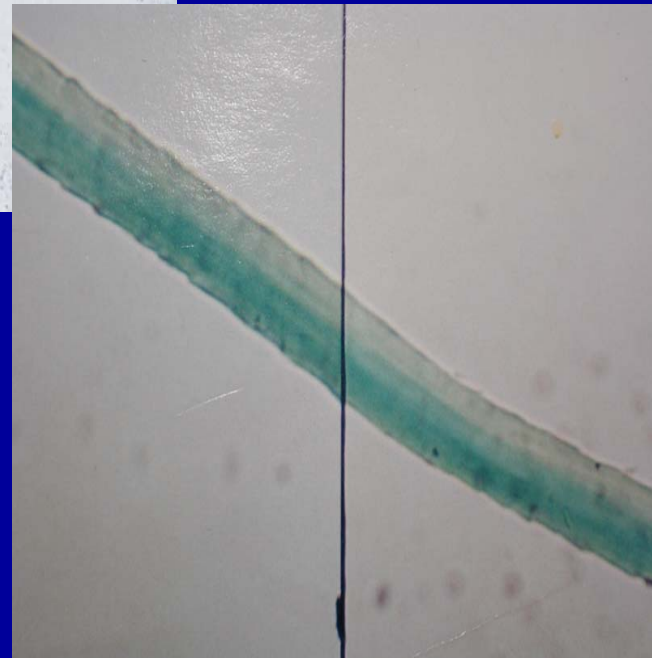
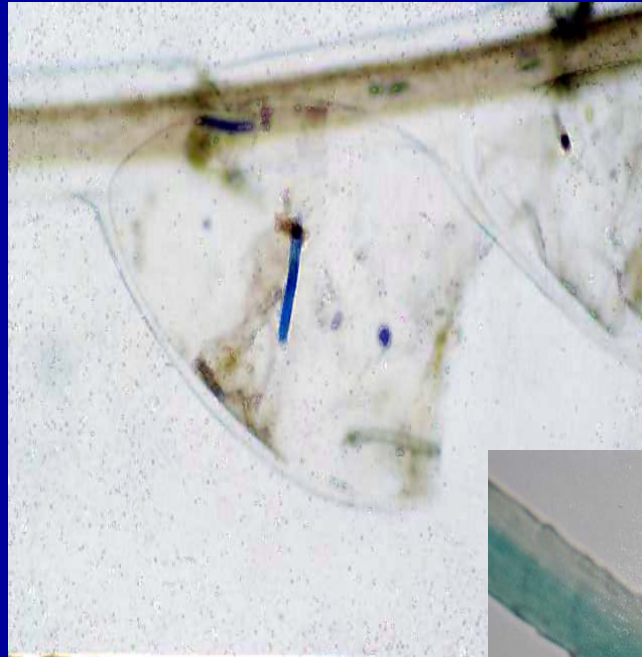
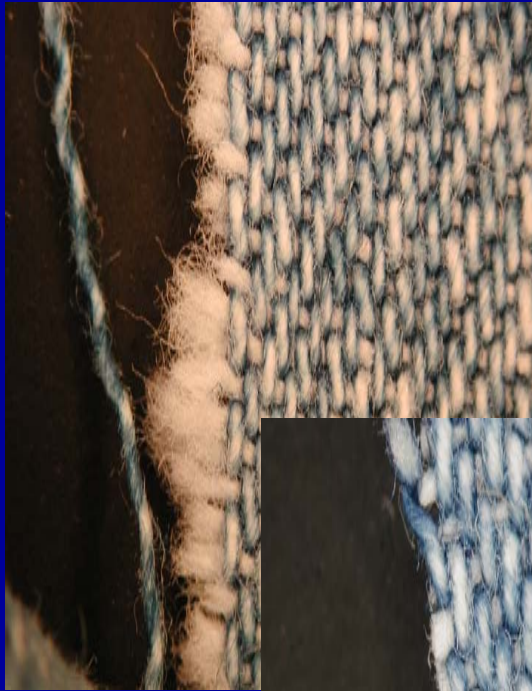
Mass Disasters



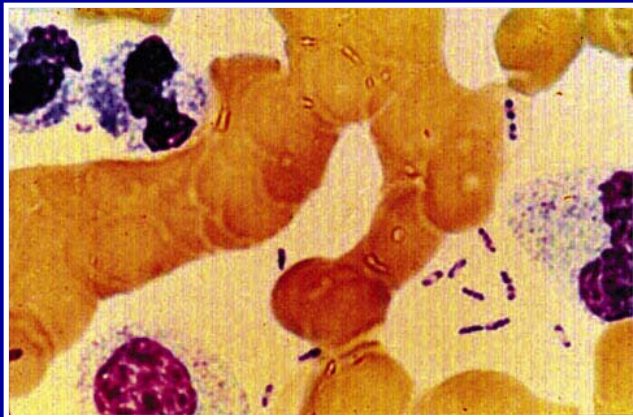
“Massacre In Madrid: Forensics Identifying The Victims.” The Independent (London), March 13, 2004.

In Spain, forensic scientists will probably have to resort to DNA analysis as they attempt to identify the more severely damaged victims of the Madrid explosions. To facilitate identification, friends and relatives may be asked to provide personal effects of the missing people that may contain remnants of DNA - such as toothbrushes or combs.

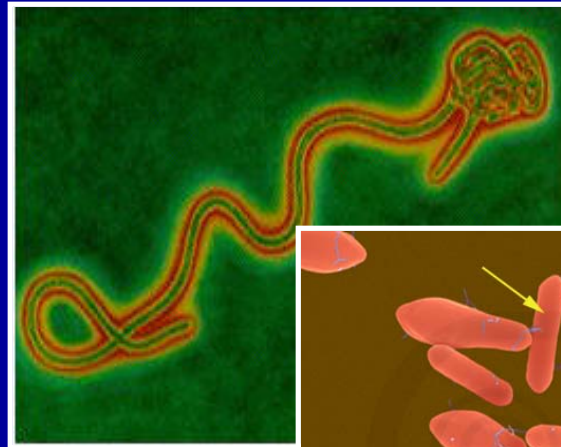
Hairs & Fibres



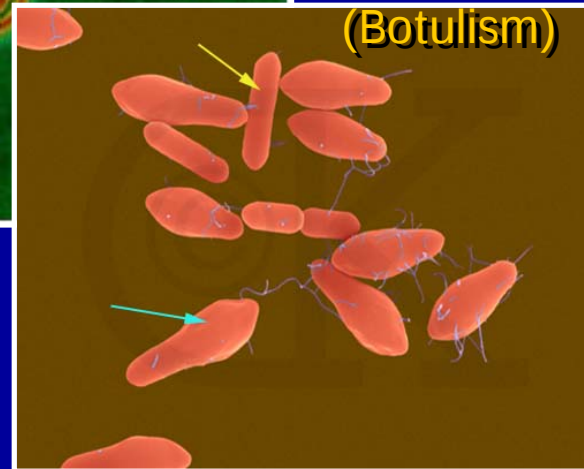
NO Testing for Biological Weapons



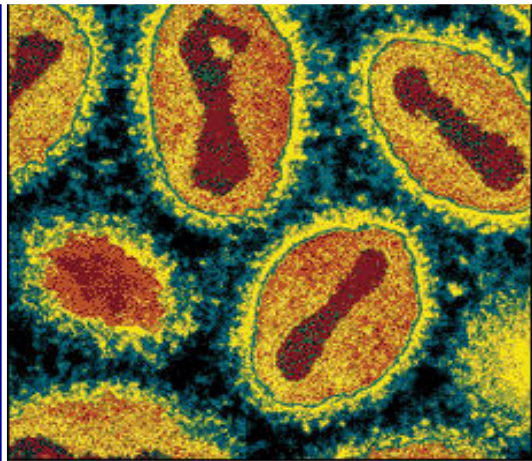
Yersinia pestis
(Black Plague)



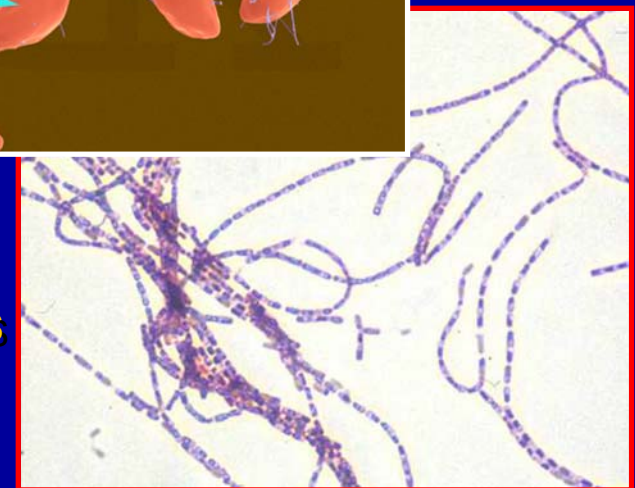
Ebola virus (Ebola
hemorrhagic fever)



Clostridium botulinum
(Botulism)



Bacillus anthracis
(Anthrax)
Variola virus
(Smallpox)



The National DNA Data Bank

- Began operation on June 30, 2000 (operated by RCMP)
- Comprised of two sets of data:
 - The Convicted Offender Index (COI)
 - At present cannot include samples from anyone else in NDDB (e.g., missing persons)
 - The Crime Scene Index (CSI)
- Information is continually cross-referenced between these indices





The ***Convicted Offender Index*** provides comparison to known offenders

Chronology of a DNA Hit:

Matching across distance and jurisdictions

Linking crime scenes together



Aug. 8, 2000: Tuesday evening a young woman had been brutally raped in Ste-Foy, Quebec



**Aug. 12, 2000:
A young woman was brutally raped
in the Toronto area**



Both Cases Were Linked through DNA

- DNA profiles were derived by the Centre of Forensic Sciences in Toronto and the Laboratoire de sciences judiciaires et de médecine légale in Montreal
- National Crime Scene Index – identified a DNA match from the evidence that was left at each crime scene

The case was also linked to the arrest in Florida of a truck driver for a similar crime

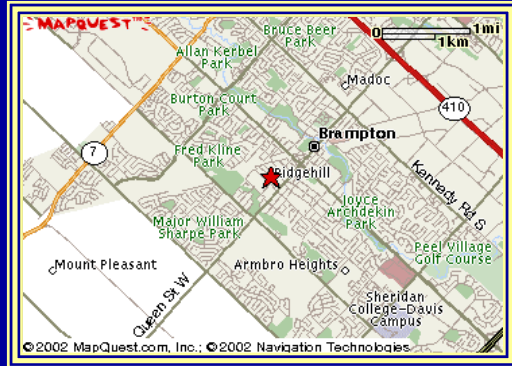
Chronology of a DNA Hit: Matching across time Linking old cases with new evidence

Brampton, ON August 27, 1991

- 12:30 AM - assailant entered apartment
- 63 year old victim was sexually assaulted and murdered in her bed
- Body was discovered next day



Chronology of a DNA Hit: Matching across time Linking old cases with new evidence



Peel homicide investigators continued to work the case over the years

- Interviewed 1000 persons
- Biological samples - including blood and hair - were collected from 370 donors
- Blood type checked for 355 people
- Centre of Forensic Sciences completed 120 DNA profile comparisons with negative results
- The investigation extended over 9 years

Chronology of a DNA Hit

Matching across time

Linking old cases with new evidence



Nov 28, 2000

Crime Scene profile submitted to the Crime Scene Index

May 4, 2001

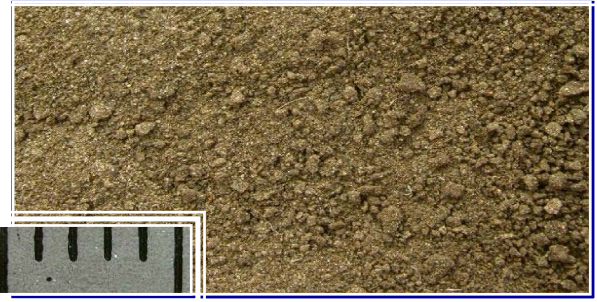
Offender profile submitted to the Convicted Offender Index

- Match established between CSI and COI same day
- Suspect identified, charged and convicted → first person in Canada charged with (& convicted of) homicide as a result of a hit from the NDDB

Chemistry

- Trace evidence
 - Glass
 - Paint
 - Soil
 - Fire debris analysis
 - Explosives
 - Gunshot residue
 - Engineering
-
- Counter terrorism initiative: post blast explosive analysis

Trace Evidence: Glass, Paint and Soil

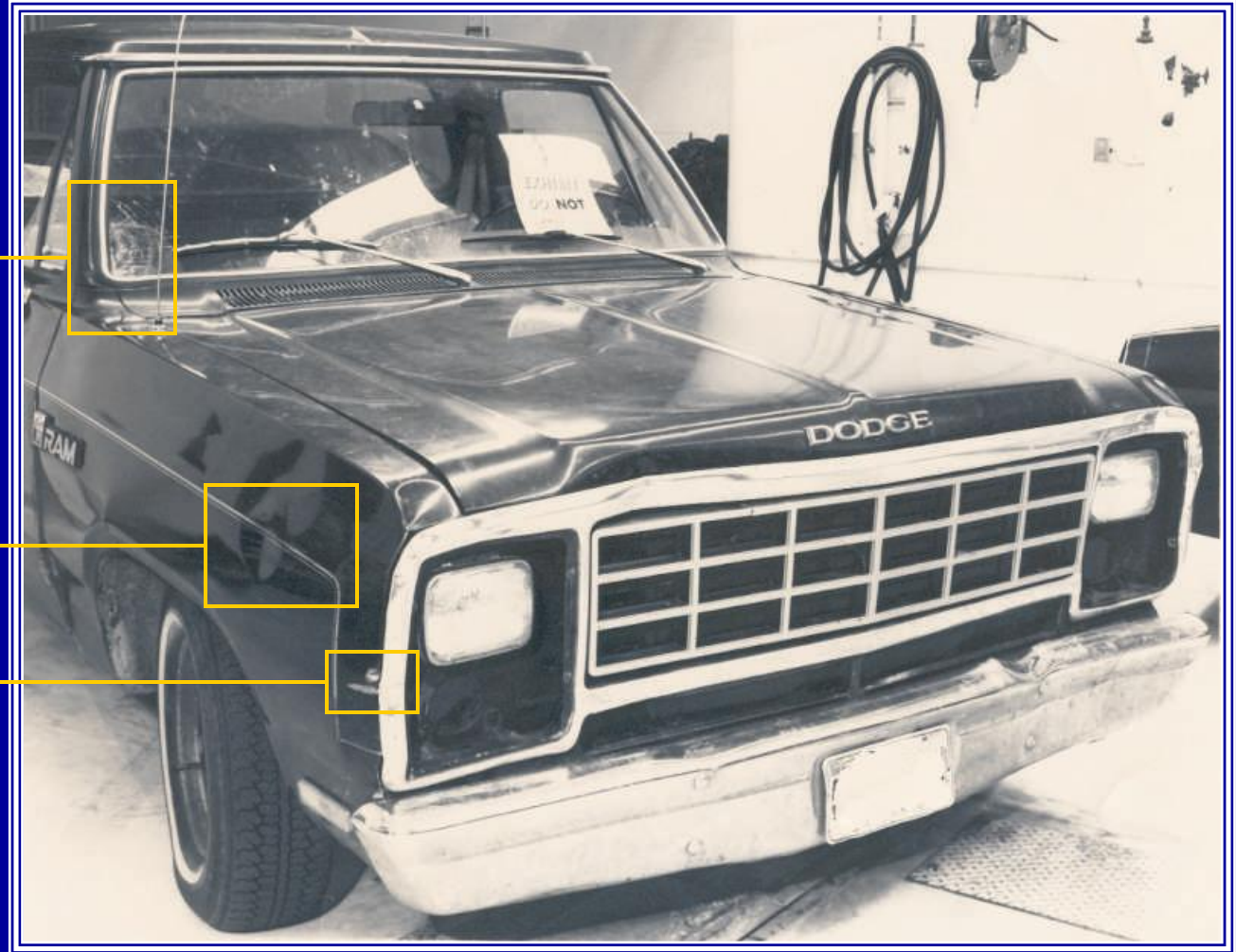


Hit and Run: Bicycle vs. Truck

Broken
windshield, glass
on victims
clothing

Transfer of black
plastic from bike
seat

Paint missing,
blue paint found
on bike carrier.



Plane vs. ?



Pilot experienced problems getting the plane to pressurize after take off. After returning to the airport, it was discovered that the plane had been damaged.

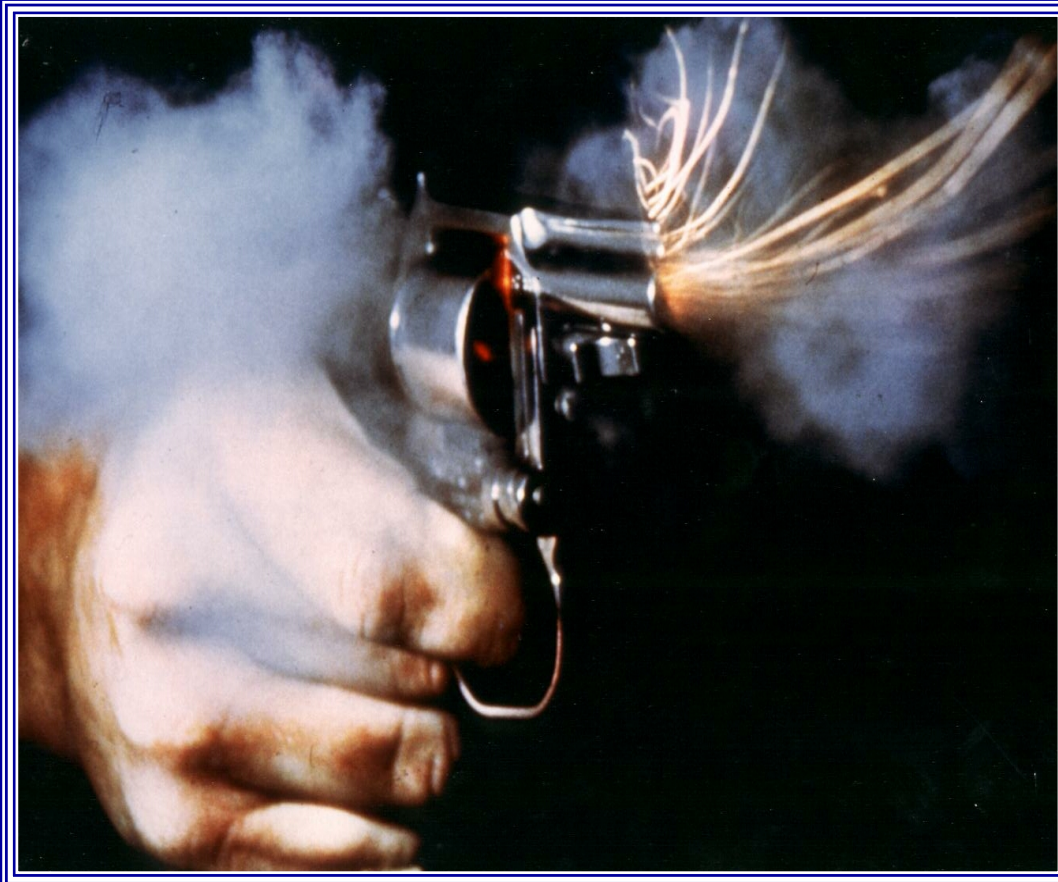
Foreign paint recovered from the plane was compared with paint from various airport service vehicles.

The suspected culprit airline was eliminated, the vehicle that caused the damage was not found.

Fire Debris and Explosives Analysis



Gunshot Residue



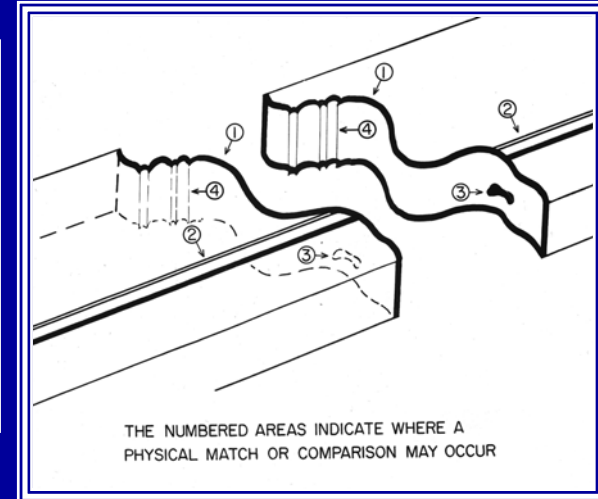
Engineering: Accident Reconstruction, Lamp Examination



Documents and Photoanalysis

- Photoanalysis
 - Specialized photography
 - Physical comparisons
 - Photographic enhancements
- Questioned Documents Examination
 - Handwriting
 - Printers, typewriters, chequewriters, etc.
 - Counterfeit documents
 - Indented writing

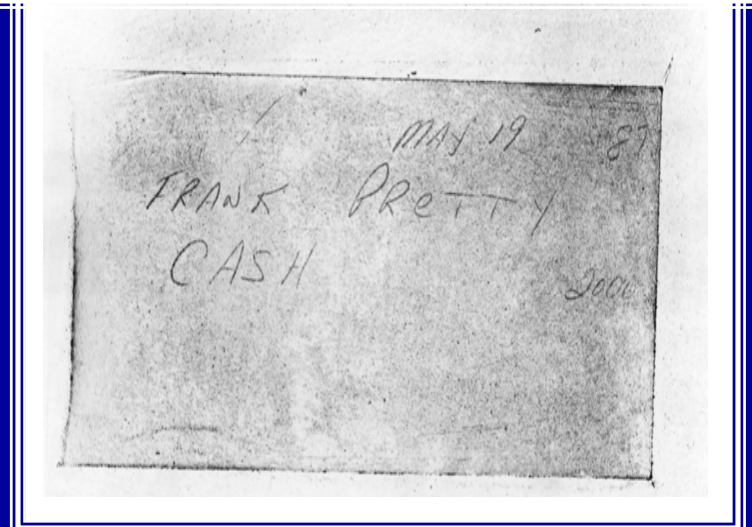
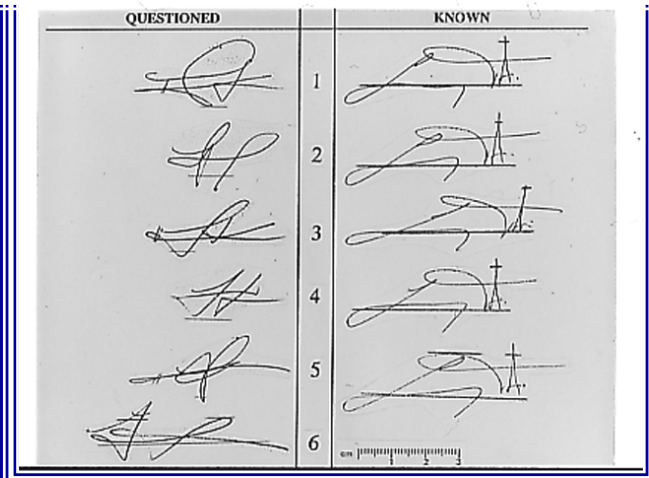
Photoanalysis



Questioned Documents



Image of a check with numbers fraudulently added to increase its value. The ink used to write the two zeros in the number "900" is different than the one used to write the remaining entries as revealed through IR luminescence and the VSC2000's integration feature.



Electronics

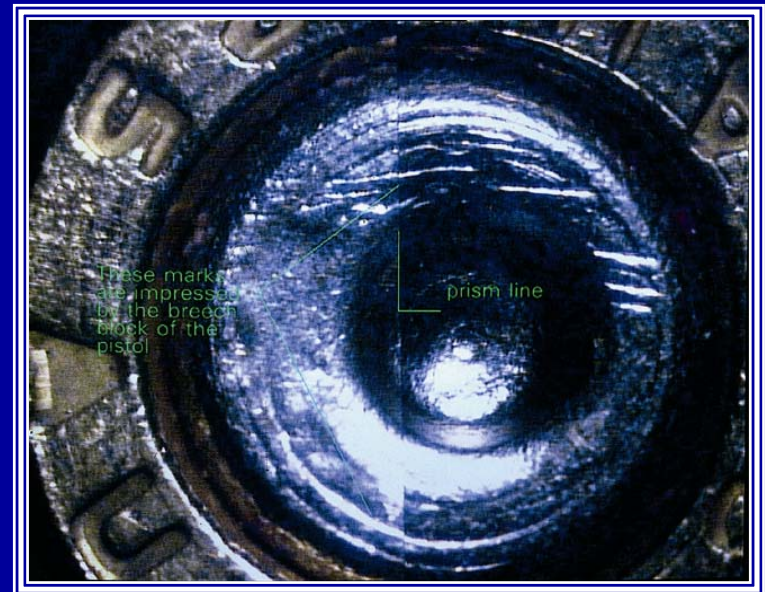
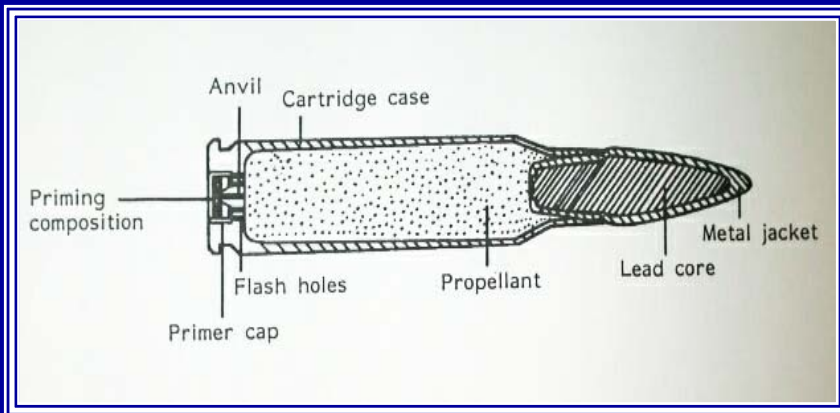
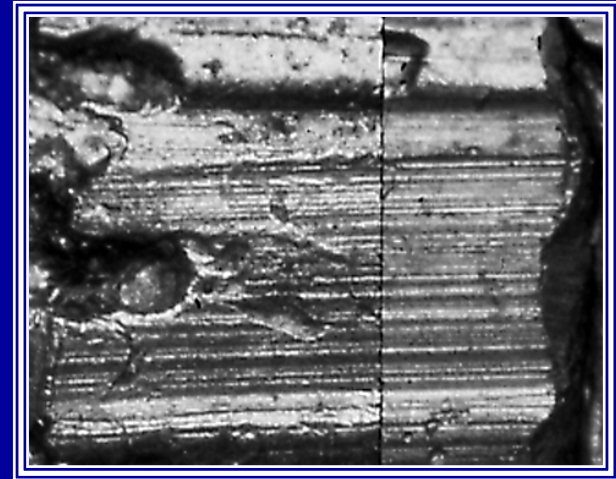
- Mobile digital devices
- Damaged devices
- Audio clarification
- Electronic weapons: stun guns & TASERS



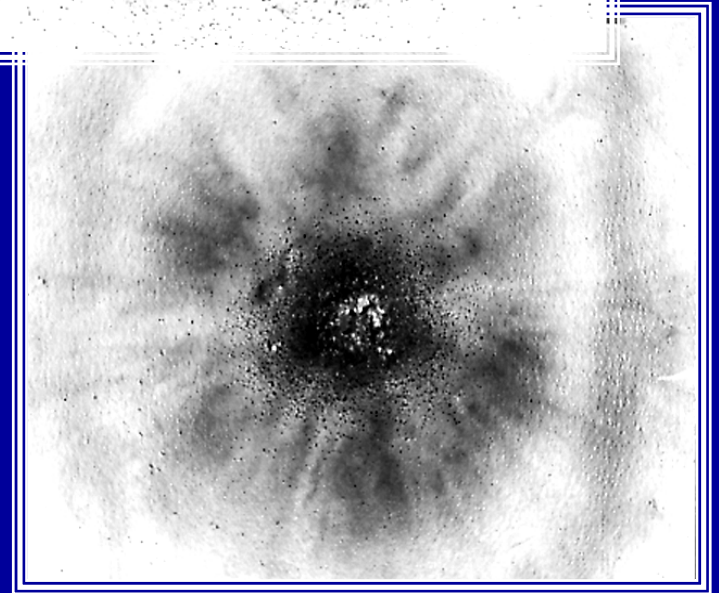
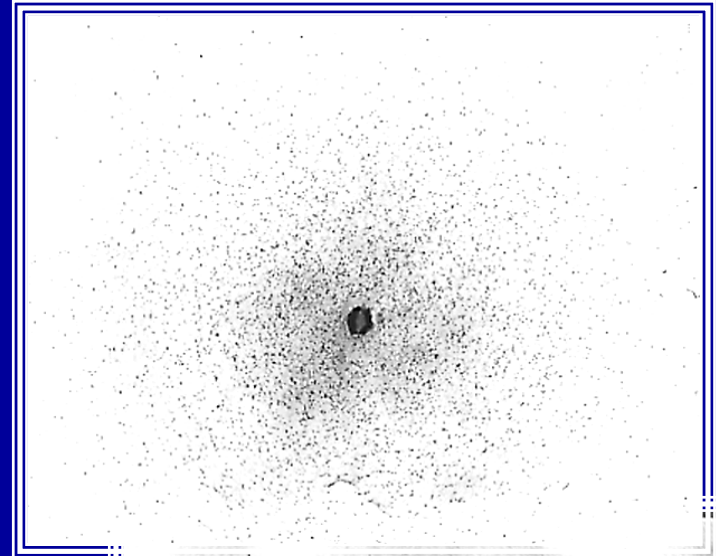
Firearms and Toolmarks

- Firearm identification & classification (& components)
- Bullets & cartridge cases
- Firing distance determinations
- Serial number restorations
- Trajectory analysis
- Striations from tools

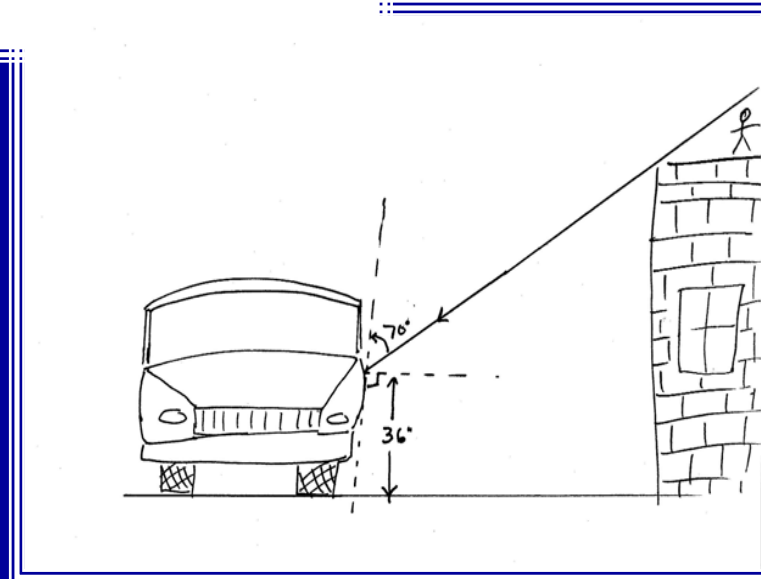
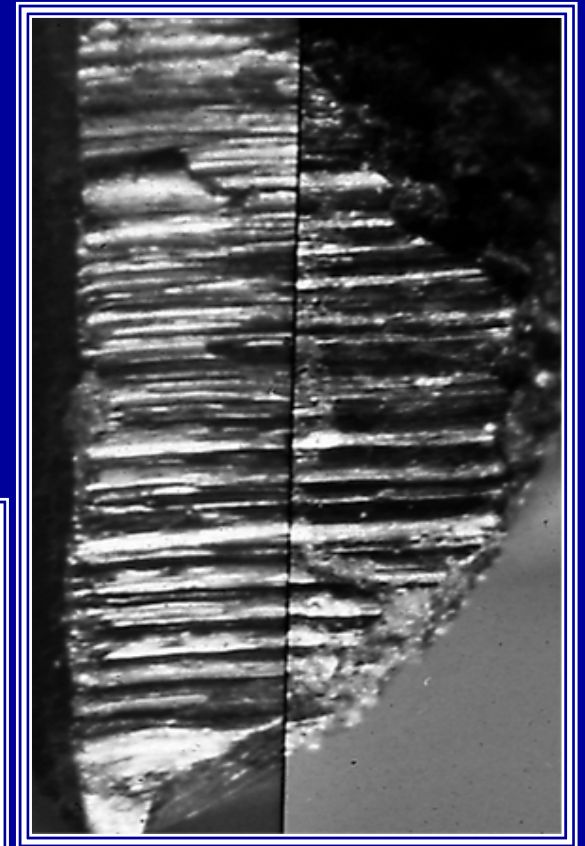
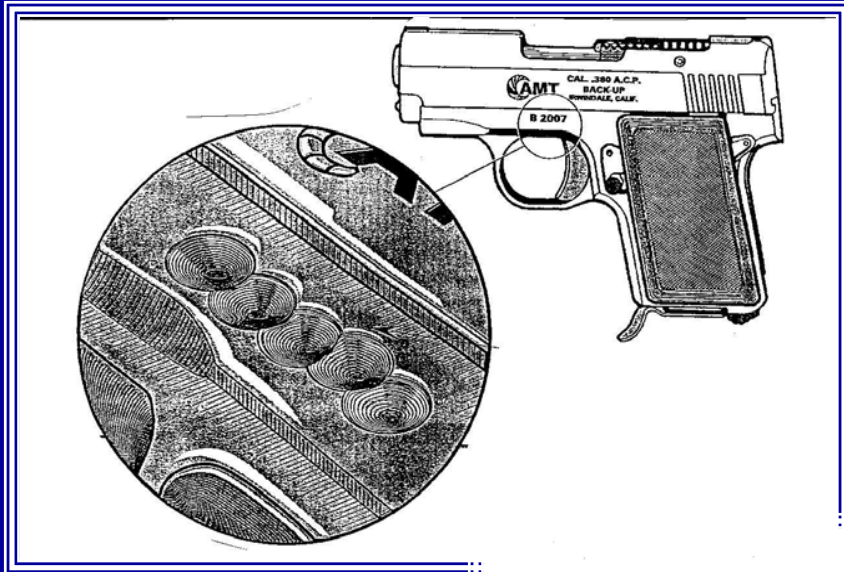
Firearms & Components, Bullets & Cartridge Cases



Firing Distance Determinations



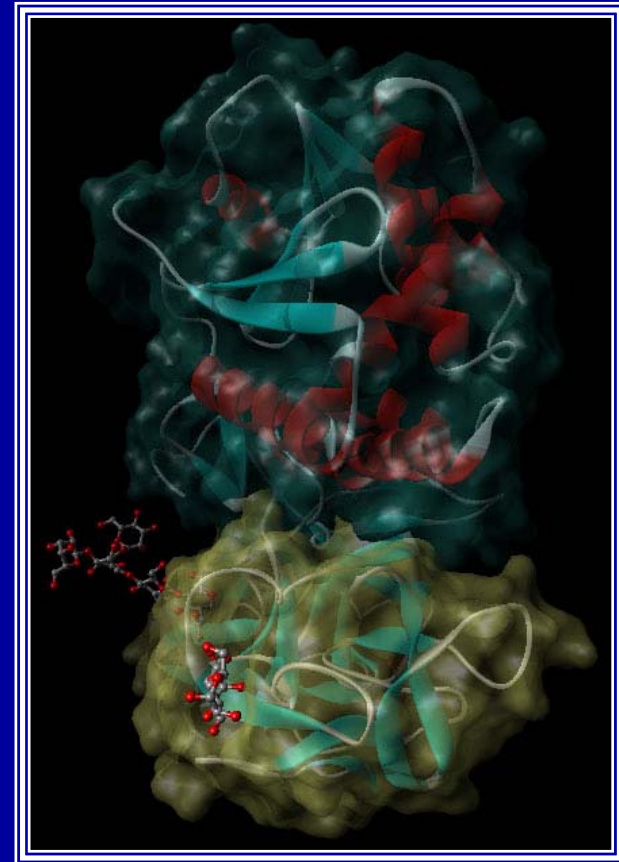
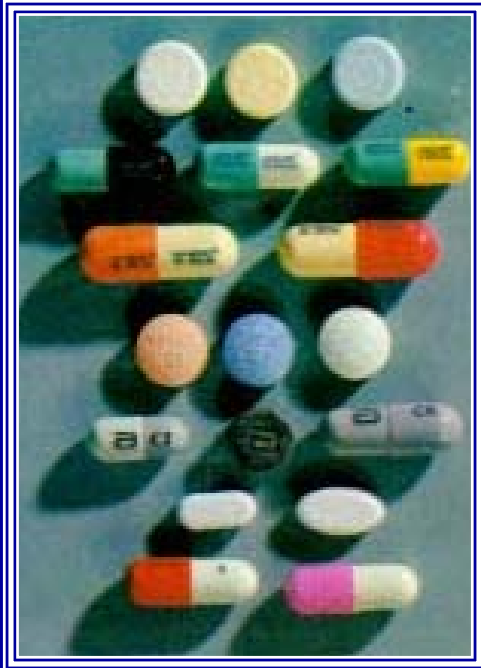
Serial Number Restoration, Trajectory Analysis, Toolmark Identification



Toxicology

- Drugs
- Poisons
- Alcohol program
- Counter terrorism initiative:
identification of chemical agents

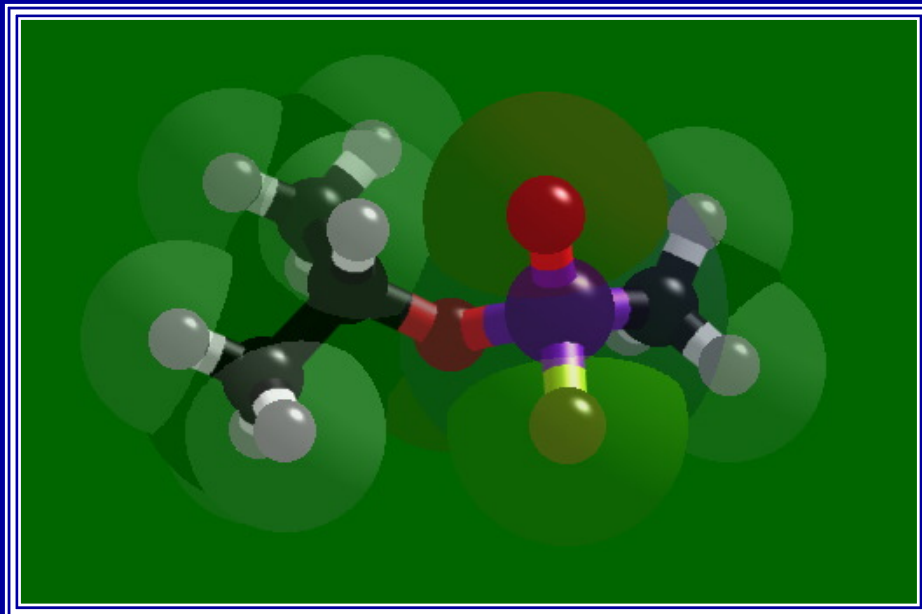
Drugs & Poisons



NO Controlled Drugs & Substances Act Cases



Identification of Chemical Agents





Alcohol, Drugs and Driving: A Forensic Perspective

What is a drug?

- Any substance, which when absorbed into the human body, can impair the ability of an individual to operate a vehicle safely.
 - Legal: - prescription or over-the-counter medications
- chemicals
 - Illicit: - drugs of abuse

Alcohol, Drugs and Driving: A Forensic Perspective

What is impairment?

- A decrease in performance resulting from the effects of a drug on the nervous system of an individual primarily.
- *R. v. Stellato* (1993)
 - any degree of impairment ranging from slight to great: marked departure from normal not required

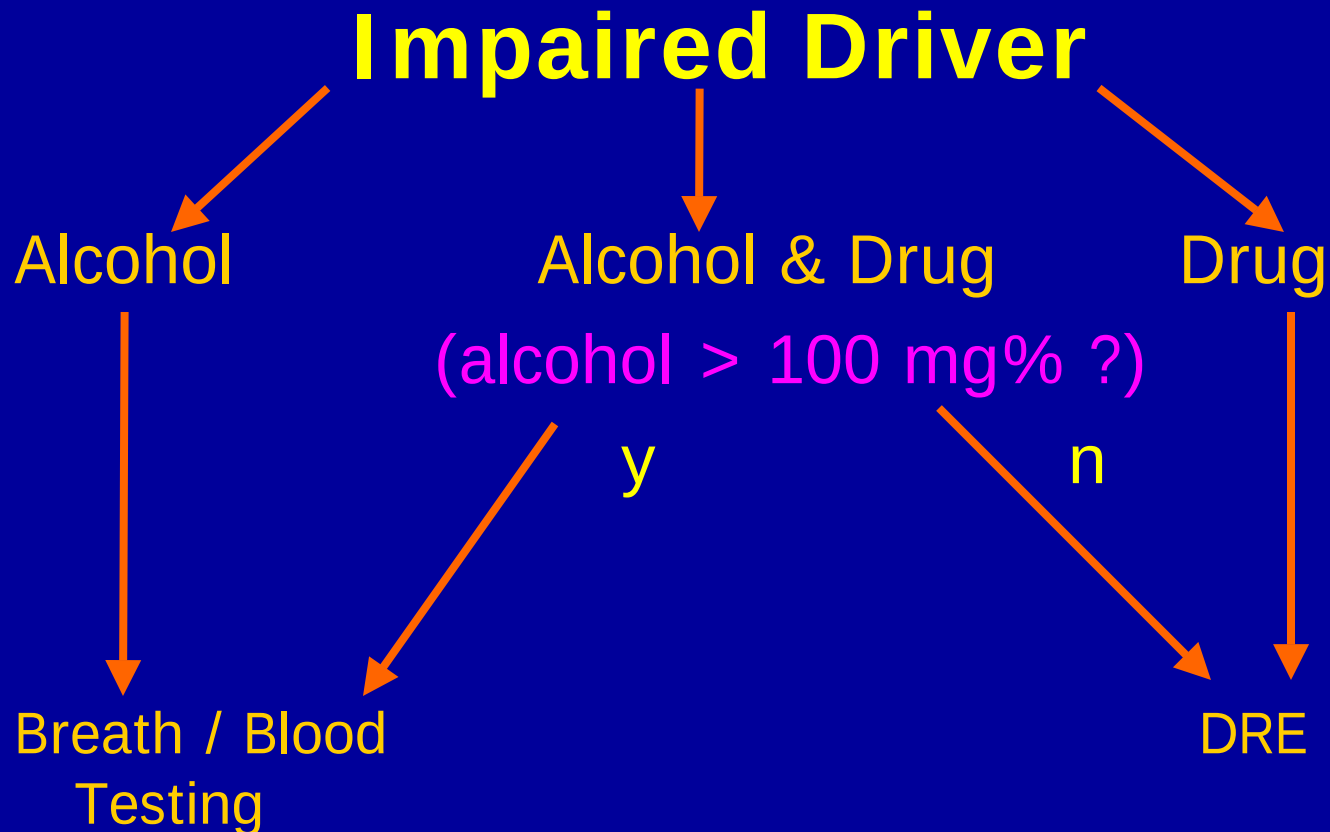
Evidence of Impaired Driving by Drugs

Driving evidence

Drug evaluation by DRE

Toxicological findings

Impaired Driving Scenarios



Application of Drug Testing

Alcohol:

- Forensic testing well established
- Correlation between BAC & impairment

Drugs:

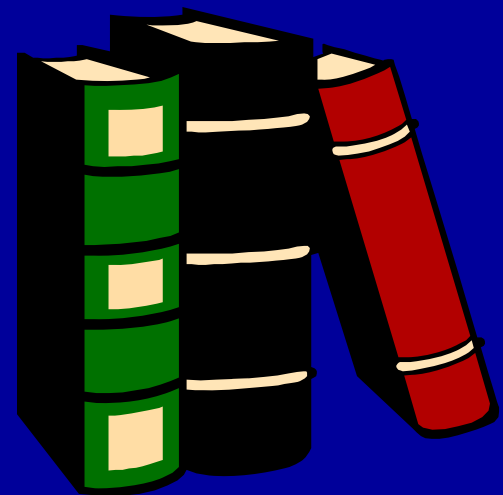
- Analytical capabilities (roadside & laboratory)
- Fate of drug in body
- Correlation between drug concentration & impairment
- Legal environment

Quality Assurance Unit

- Oversees the CFS Quality Assurance (QA) Program, which provides the framework for the delivery of objective, relevant and reliable results
- Responsible for the compliance of the laboratory to accreditation standards including:
 - the security and integrity of evidence and all related documentation;
 - the use of validated procedures; and
 - on-going quality assessment through practical testing, document review and regular audits.
- Responsible for CFS policies and procedures

Library and Training Unit

- The Training Unit is responsible for the training & professional development of CFS staff and for client education
- The CFS Library is available to forensic professionals by appointment only
 - It is not open to the public



Client Education Information

- The CFS Organizational Development Section provides forensic science education services to CFS clients and stakeholders upon request.
 - To request a lecture send an email to
***CFS.LectureRequests@Ontario.ca**
 - Include Name, Organization, and requested dates
- If you have any specific forensic science education requirements, please feel free to contact the Centre for more information :
 - Kimberley Johnston, (A) Section Head, Organizational Development:
 - Tel: 416-314-3267
 - E-mail: **kimberley.johnston@ontario.ca**
 - Tina Baker, Training Assistant - Training Unit:
 - Tel: 416-314-3654
 - E-mail: **tina.baker@ontario.ca**