

Making a **Difference** Canada

Communities Giving Voice to Sexual Assault Victims

FAIRNESS. OBJECTIVITY. DUE DILIGENCE.

This is what survivors of sexual assault should be met with.

Makingadifferencecanada.ca

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“Sexual Assault: A Collaborative Response” Workshop

Cornwall, PEI - December 5, 2006



Outline

- **Laboratory overview**
 - sections involved in investigations of sexual assault
 - case prioritization and turn around times for Biology Section
- **Forensic DNA analysis**
 - biological evidence
 - DNA typing
 - National DNA Data Bank
- **Sexual assault evidence**
 - sexual assault examination kit
 - other evidence types

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Laboratory Overview

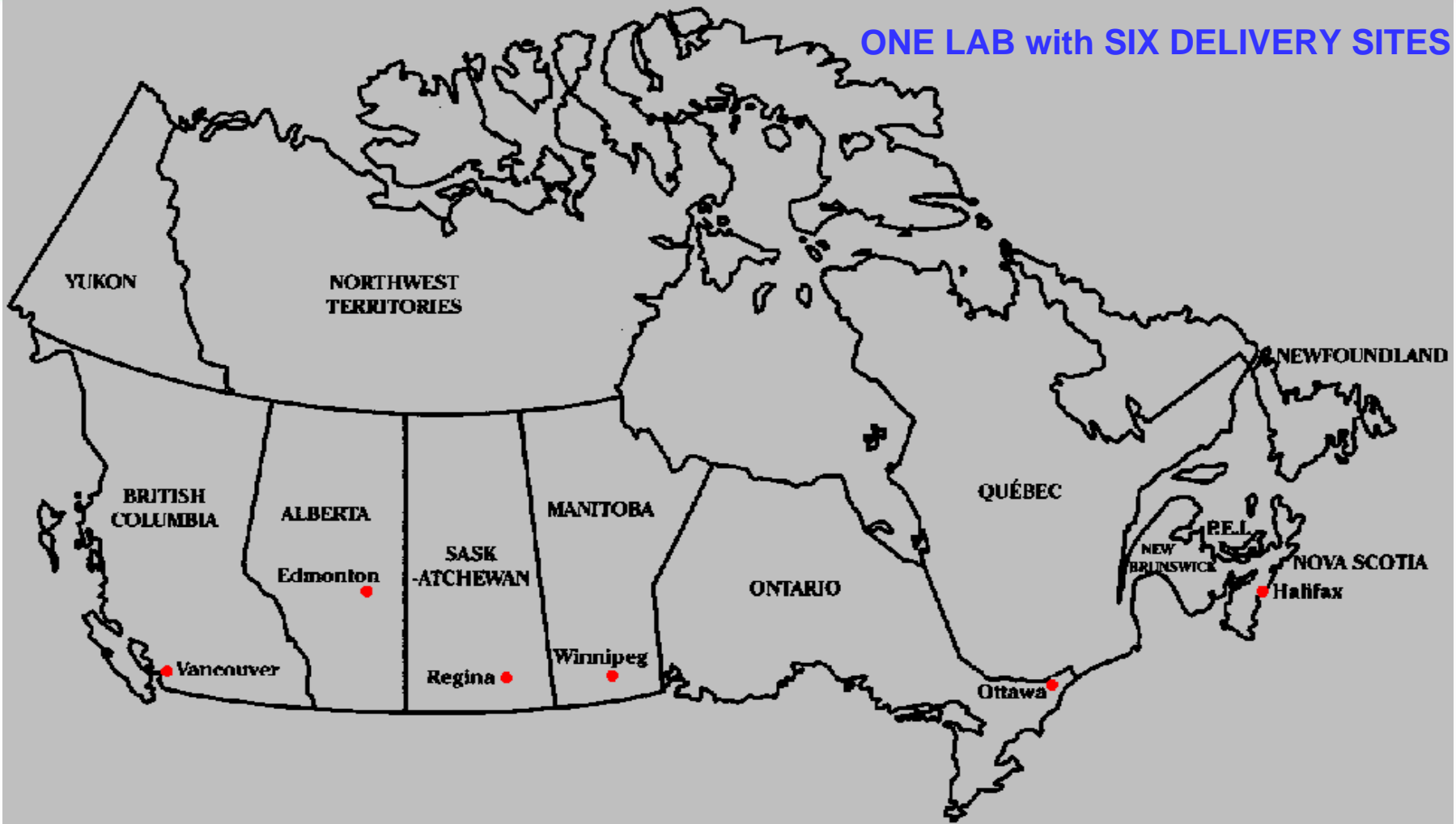


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ONE LAB with SIX DELIVERY SITES



RCMP Forensic Labs in Canada



Laboratory Overview

- **Case Receipt Unit**
- **Trace Evidence**
- **Toxicology Services**
- **Evidence Recovery Unit**
- **Biology**
- **Firearms**
- **Counterfeits & Documents**



Case Receipt Unit (CRU)

- **point of contact for investigators**
- **handle all general and specific client inquiries**
- **preauthorization of cases:**
 - **ensures that only designated offence cases are accepted**
 - **exhibit selection for submission**
 - **determination of examinations to be conducted**
- **coordination and prioritization of laboratory casework**
- **exhibit receipt, storage, maintenance and return**
- **1-866-NPS-LABS (1-866-677-5227)**



Trace Evidence

- textiles and fibres
- sexual lubricants
- tapes and adhesives
- cosmetics
- glass
- paint
- fire debris
- explosives
- metals
- petroleum products
- plastics
- building products
- safe insulation



Toxicology Services

- **drugs and alcohol**
- **quantitative and qualitative identification of substances in biological and non-biological samples (provides an actual level)**
 - **confirm identity of substances present**
 - **exclude the presence of other substances**
- **provide an opinion by relating the analytical findings to effects on behavior and/or state of health**



Evidence Recovery Unit (ERU)

- **search exhibits for biological and non-biological trace evidence (recovery, identification and preservation)**
- **biological materials**
 - blood, semen, hair, saliva, urine, feces, tissue, epithelial cells
- **assessment of textile damage**
- **recognition of other evidence types**
- **forward most probative evidence for analysis**



Biology Section

- **further evaluation of biological materials identified by ERU**
 - develop DNA profiles of known and questioned samples
 - comparison of profiles
 - statistical evaluation of matching profiles
 - paternity/parentage calculations
- **court testimony**
- **liaison with National DNA Data Bank**



Case Priority Levels

Urgent:

- diary date for completion is 15 days
- any request for service where there is an immediate threat to:
 - national security
 - community safety
 - evidence integrity



Case Priority Levels

Routine:

- all requests for service that do not meet the urgent criteria
- Estimated Diary Date (EDD) for DNA analysis is currently 6 months
- some cases that do not meet the criteria for urgent may be flagged to be dealt with in a timely fashion
- system in place to stream cases to ensure that the most serious cases are examined first



Case Priority Levels

Relevant Criminal Codes have been reviewed and categorized into three areas based on the seriousness of the offence:

- A stream:** most serious primary designated offences
(Murder, Sexual assault, Sexual assault with
Weapon, Aggravated Sexual Assault, etc.)
- B stream:** remaining primary designated offences
- C stream:** all secondary designated offences (Break and
Enter with Intent, Causing Death by Criminal
Negligence, etc.)

A stream cases > B stream cases > C stream cases

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Biological Evidence & Forensic DNA Analysis

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Locard's Exchange Principle

- whenever two objects come into contact, a transfer of material will occur



Sources of Biological Evidence

Blood

Semen

Saliva

Urine

Hair

Teeth, Bone & Tissue

Epithelial Cells



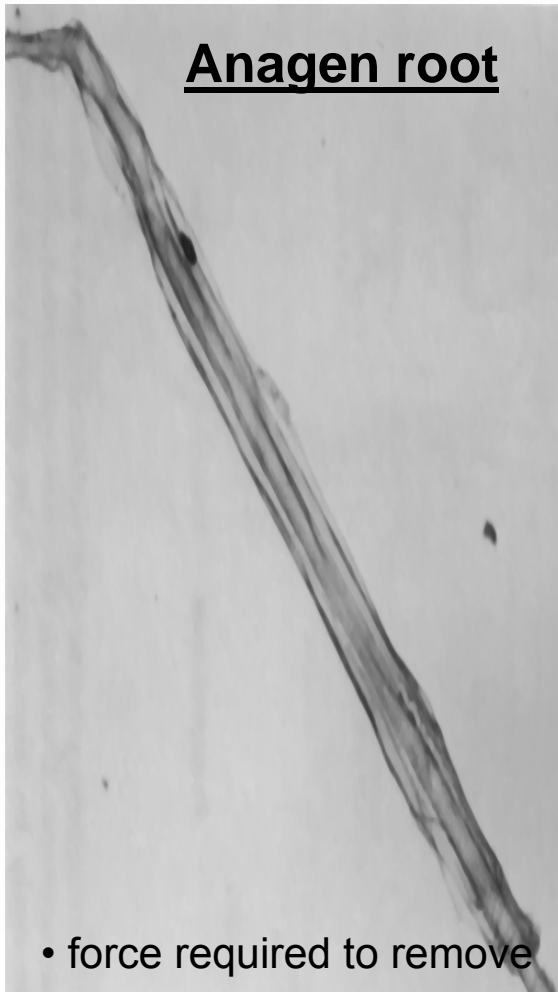


Hair Examination

- **identification of human vs animal hair**
- **identification of probable body area of origin**
 - scalp hair
 - pubic hair
 - body hair
- **roots are assessed to determine**
 - suitability for DNA analysis
 - root type



Hair Examination





Identification of Biological Trace Evidence

- **visual examination / alternate light source**
- **presumptive tests (it could be...)**
 - **blood**
 - **semen**
 - **saliva (if requested)**
 - **urine (if requested)**
 - **feces (if requested)**
- **confirmatory tests (it is...)**
 - **blood**
 - **semen**



Identification of Blood

Presumptive Test – Hemastix test; is not specific for blood but rather a search tool for screening of stains that may require further testing

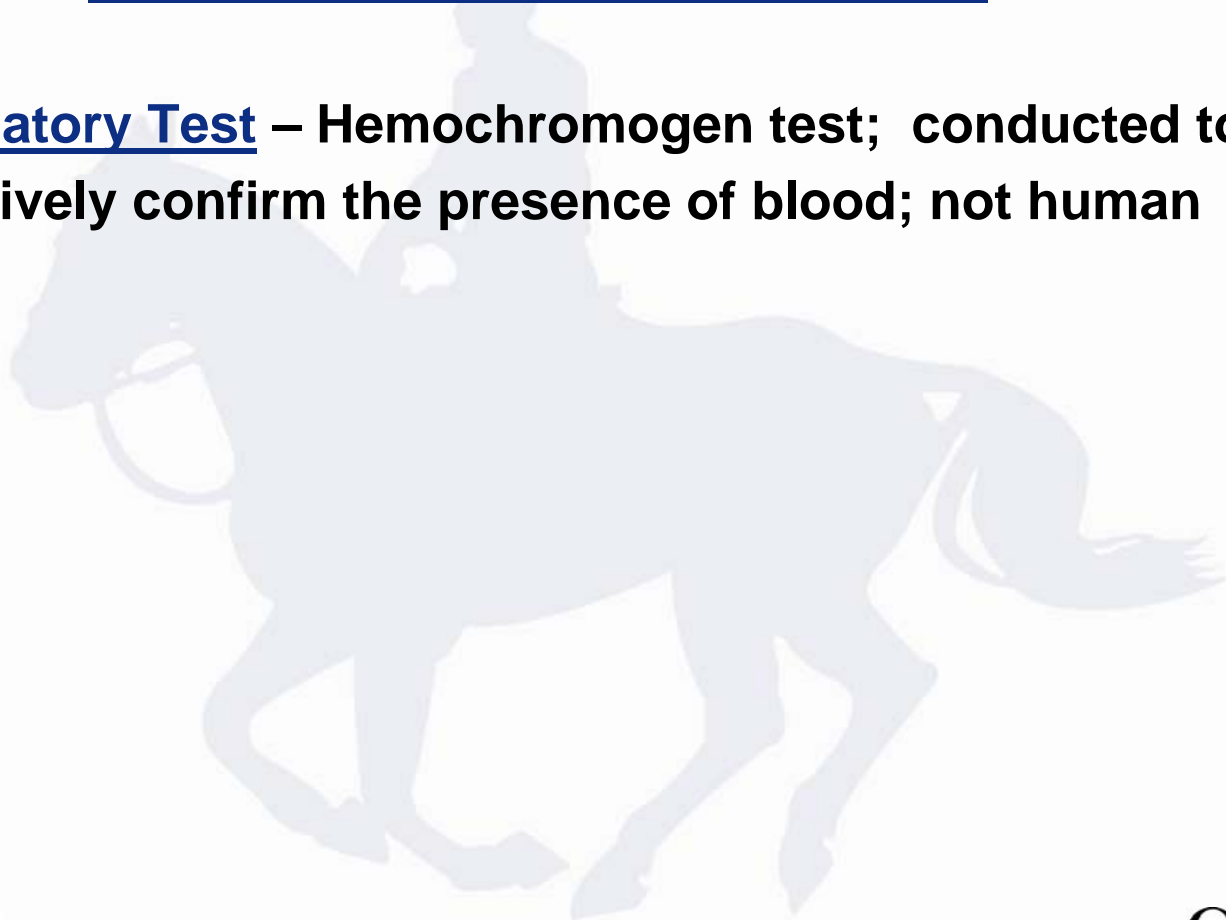
False positives: certain metals and oxidized metals (copper, rust), suedes and leathers, dirt and molds, fresh grass stains or other vegetable matter containing peroxidase activity, fecal material, perspiration and saliva, hypochlorites (bleach)

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Identification of Blood

Confirmatory Test – Hemochromogen test; conducted to conclusively confirm the presence of blood; not human specific





Identification of Semen

Presumptive Test

Fast Blue: tests for enzyme (acid phosphatase) in seminal fluid; present in vasectomized males

False positives: *fecal matter, vaginal secretions, vegetable material, yeast, some contraceptive foams and jellies, carbolic soaps*



Identification of Semen

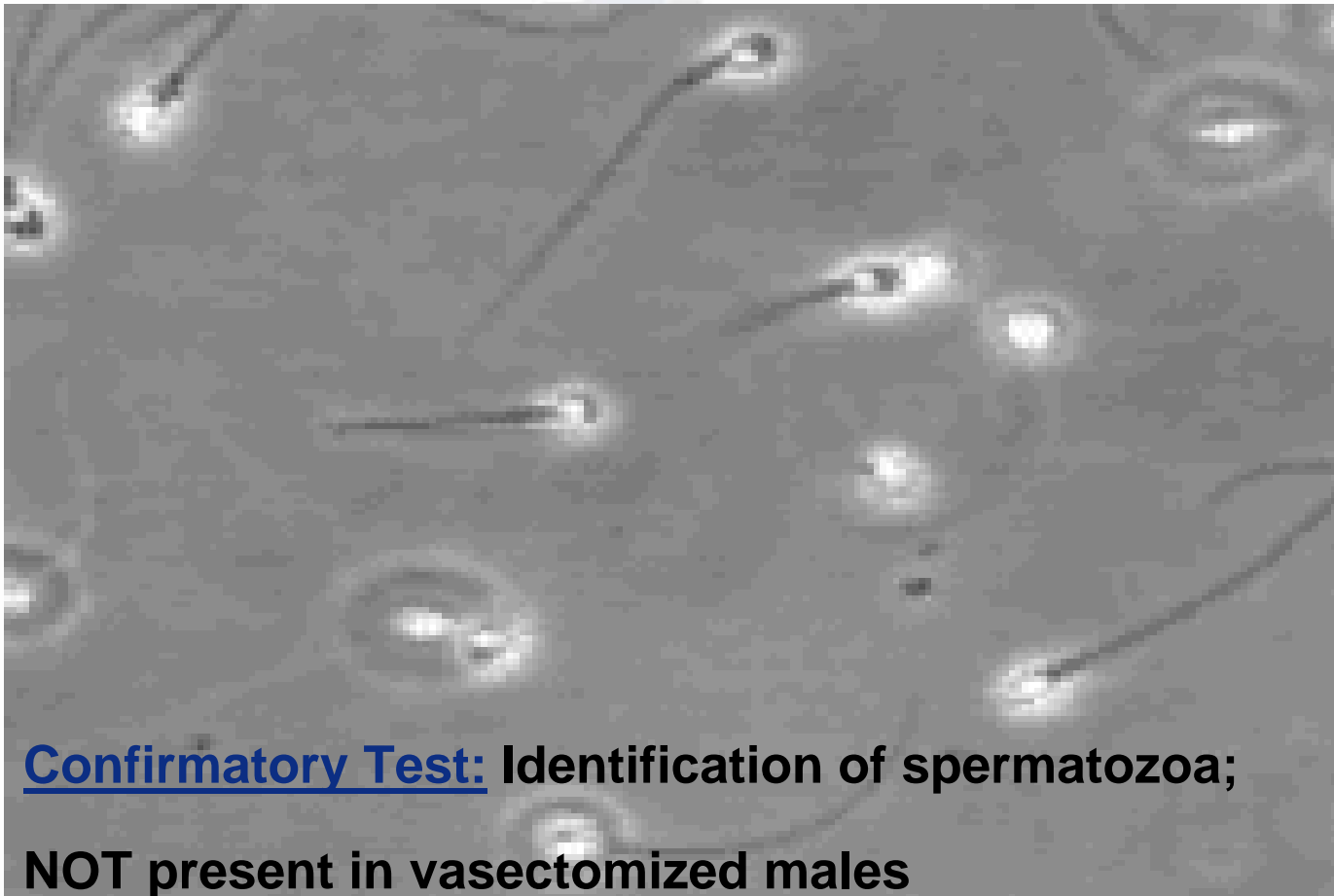
Presumptive Test (cont.)

PSA: tests for prostate specific antigen (p30) found in seminal fluid; present in vasectomized males

False positives: breast milk, amniotic fluid, urine; some literature suggests additional biological materials if individual is on oral contraceptives or anti-depressants, under conditions of varying hormonal levels



Identification of Semen



Confirmatory Test: Identification of spermatozoa;

NOT present in vasectomized males

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DNA = DEOXYRIBONNUCLEIC ACID



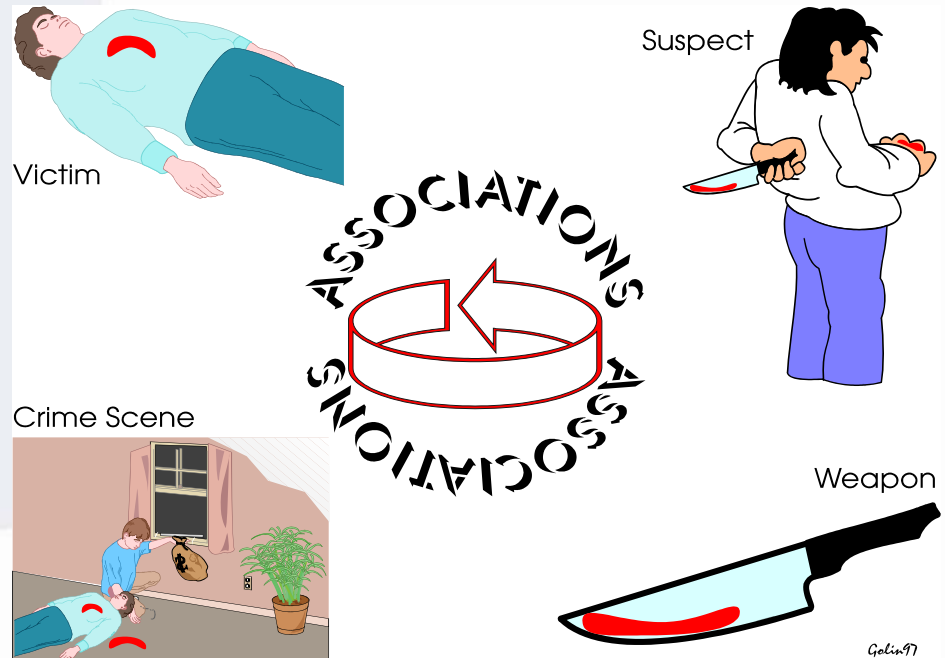
Why is DNA useful in forensics?

- no two individuals have identical DNA (except identical twins)
- DNA is present in essentially every cell in the body
- DNA is identical in every cell
- DNA is the same throughout your lifetime
- the sex of an individual can be determined from DNA
- DNA is inherited, the genetic blueprint for life – $\frac{1}{2}$ of DNA is inherited from the mother and $\frac{1}{2}$ from the father



Significance of Forensic DNA Evidence

- provides associations
- may corroborate witness testimony
- identification or elimination of suspect
- provides investigative leads





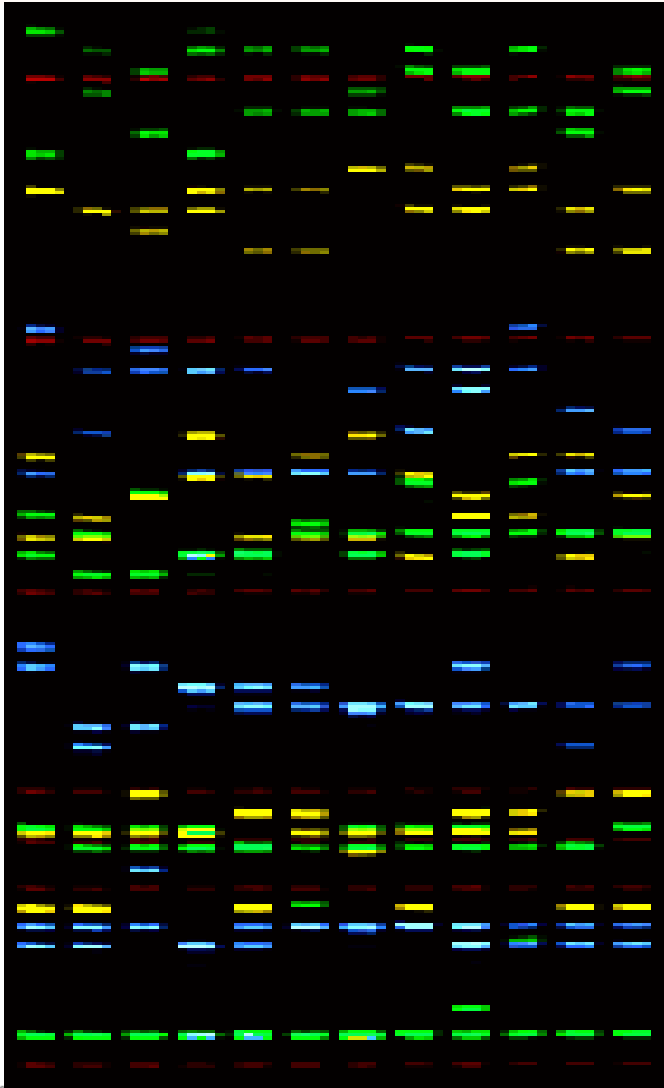
Forensic DNA Analysis

- **only examine regions of DNA where individuals are known to display variation**
 - 99.9% of our DNA is the same
 - the 0.1% of our DNA that is different = 3 million places where we're different
- **RCMP protocol simultaneously examines 9 regions of DNA and sex chromosomes**



Generation of a DNA Profile

Raw DNA data is processed into a simplified numerical format





EXAMPLE OF A DNA PROFILE

Locus	Allele 1	Allele 2
D3S1358	15	17
vWA	17	17
FGA	21	21
Amelogenin	X	Y
D8S1179	14	15
D21S11	28	30
D18S51	16	19
D5S818	11	11
D13S317	11	12
D7S820	11	12



DNA Typing - Interpretation

Comparison of questioned samples to known samples - three types of conclusions:

- **Non-Match or Exclusion**

- the donor of the known sample is not the source of the DNA profile of the questioned sample

- **Match or Inclusion**

- the DNA profile of the questioned sample matches that of the known sample

- **Not Interpretable**

- the DNA profile of the questioned sample is incomplete or of a complex nature and no conclusion can be made



DNA Typing - Interpretation

- **when two samples match, what does it mean?**
 - need to determine how common a particular profile is in the population
- **known frequency for each allele at each of the nine regions of DNA**
 - based on databases composed of randomly chosen individuals
- **using simple formulae, the final frequency for the entire profile is obtained**

“The estimated probability of selecting an unrelated individual at random from the Canadian Caucasian population with the same profile is 1 in 97,000,000,000” (or 1 in 97 billion)

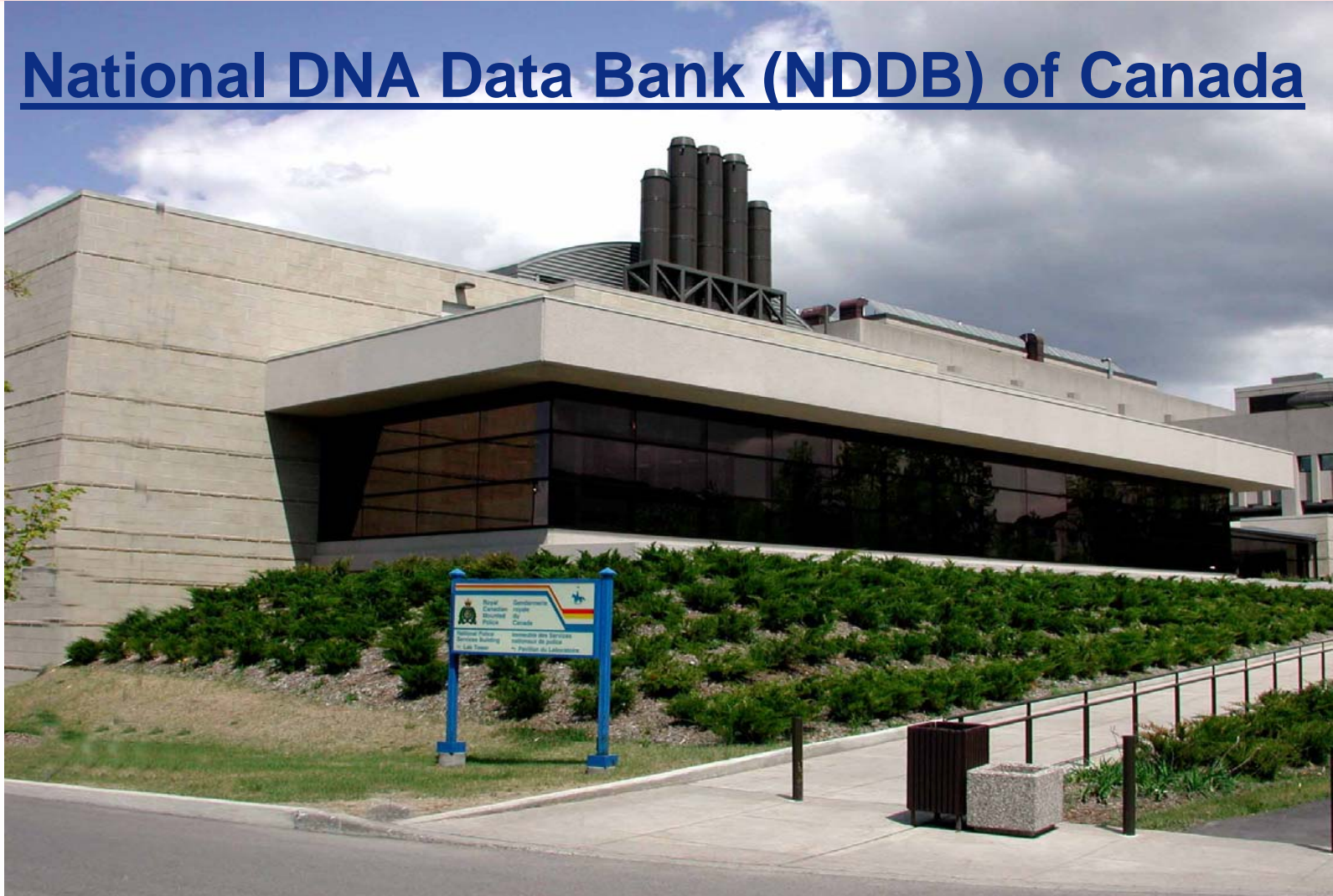
- **bottom line - not a common profile**

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National DNA Data Bank (NDDDB) of Canada





National DNA Data Bank (NDDDB)

CODIS - Combined DNA Index System

- a software program provided at no cost to the RCMP by the FBI and U.S. Department of Justice
- creates a national information repository where labs can store and share DNA information



National DNA Data Bank (NDDDB)

- two key components:
 - Crime Scene Index (CSI)
 - DNA profiles from evidence left at crime scenes
 - victim's DNA profiles are NOT entered
 - known samples are NOT entered
 - Convicted Offender Index (COI)
 - DNA profiles of offenders convicted of specific, designated offences
- www.ndddb-bndg.org



National DNA Data Bank (NDDDB)

- a powerful investigative tool designed to assist law enforcement agencies in solving crime
- DNA profiles in the Crime Scene Index are compared to other crime scene profiles and to the Convicted Offender Index to
- link crime scenes
- identify suspects
- eliminate suspects
- determine if a serial offender is involved



National DNA Data Bank (NDDDB)

Profiles Entered (as of November 20, 2006):

- 104,395 profiles entered into Convicted Offender Index
- 31,621 profiles entered into Crime Scene Index

Match Inventory Report (as of November 20, 2006):

- 6,131 Offender Hits - Crime Scene to Offender
- 912 Forensic Hits - Crime Scene to Crime Scene



National DNA Data Bank (NDDDB)

Investigations assisted (as of November 20, 2006):

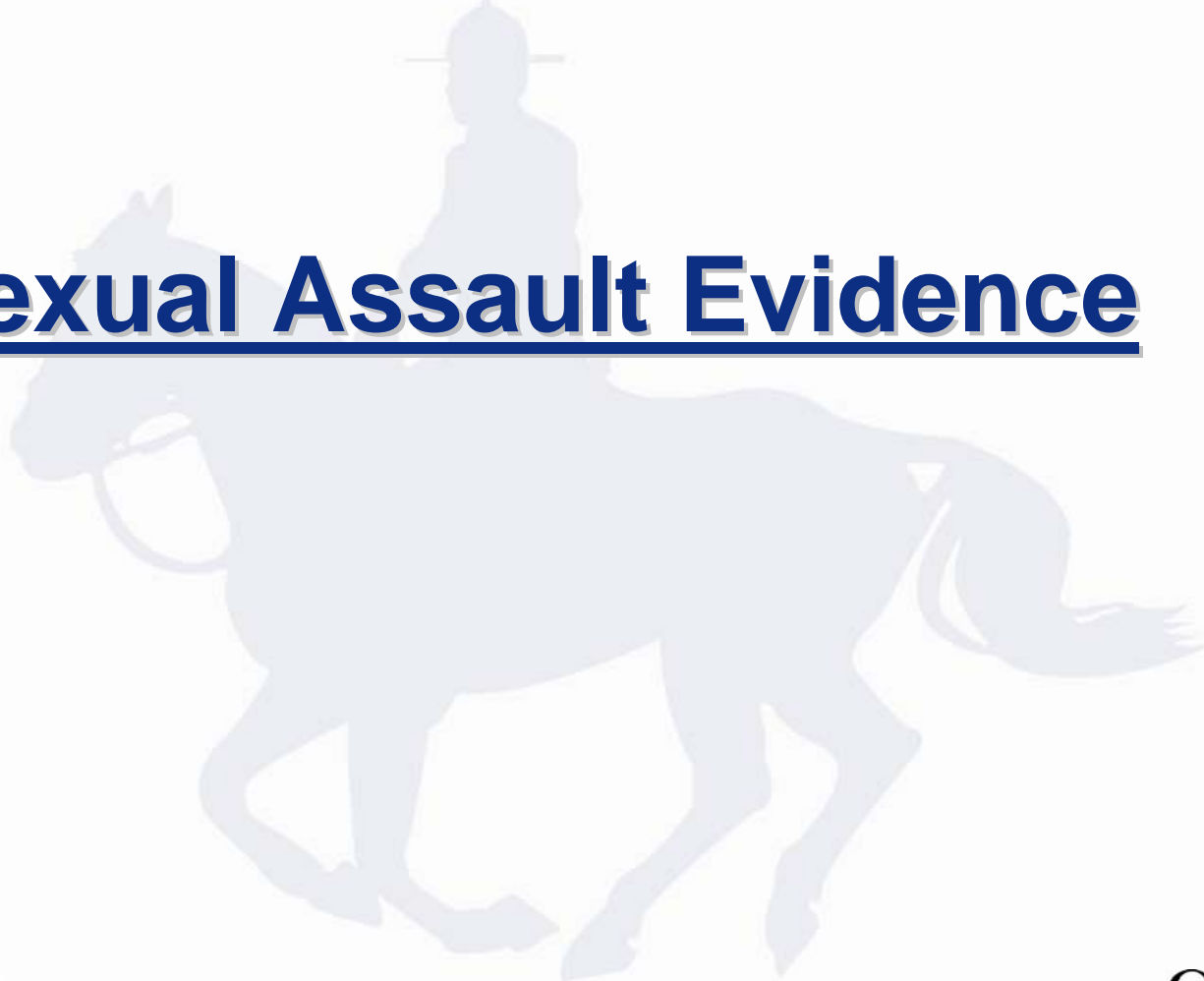
• Murder	379
• Sexual Assault	857
• Attempted Murder	138
• Robbery (Armed)	728
• Break & Enter with intent, committing offence or breaking out	3,520
• Assault (+)	400
• Other	<u>109</u>
	6,131

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Sexual Assault Evidence





Goals of Laboratory Examination

- establish contact (hairs, fibres, any cellular material)
 - Note: not relevant if complainant and suspect are known to each other
- establish sexual contact (semen, pubic hair, biological fluid in suspect's / complainant's underwear or on/in body)
- corroborate complainant or suspect account of events
- corroborate the use of force (blood, pulled hairs, textile damage)
- DNA CANNOT prove that an assault occurred!



Sources of Evidence

- **Complainant(s)**
 - sexual assault examination kit
 - clothing
- **Suspect(s)**
 - evidence from the body
 - clothing
 - object(s) used during assault
- **Scene(s)**



The Sexual Assault Examination Kit

- **collected by trained medical personnel**
- **often the most probative exhibits**
 - these exhibits usually examined first
 - if semen is found, usually no other examinations are done (unless case circumstances indicate multiple assailants, consensual intercourse, etc.)
- **may be necessary to submit known sample(s) from anyone who had consensual intercourse with the complainant within 72 hours of kit collection**



The Sexual Assault Examination Kit (Female Complainant)

- motility check slide
- vaginal swabs & smear
- vaginal pool / wash
- anal swabs
- rectal swabs
- external genitalia swabs
- oral swabs
- body stain swabs
- breast swabs
- swabs of bite marks/saliva
- stains on pubic/scalp hair
- pubic hair combings
- fingernail clippings/scrapings
- foreign matter/debris
- tampon/sanitary pad
- jewelry and body piercings
- clothing
- known blood (or buccal) sample



The Sexual Assault Examination Kit (Male Complainant)

- penile swabs
- scrotum swabs
- anal swabs
- rectal swabs
- oral swabs
- body stain swabs
- swabs of bite marks / saliva
- stains on pubic/scalp hair
- pubic hair combings
- fingernail clippings/scrapings
- foreign matter/debris
- jewelry and body piercings
- clothing
- known blood (or buccal) sample



The Sexual Assault Examination Kit (Child Complainant)

- vaginal swabs
- penile swabs
- anal swabs
- rectal swabs
- oral swabs
- body stain swabs
- swabs of bite marks / saliva
- external genitalia swabs
- diaper / clothing
- known blood (or buccal) sample



Evidence Collection - Clothing

- **clothing collected first**
 - **complainant undresses standing on paper**
- **is clothing the same as time of assault?**
 - **if yes, usually all items except shoes and socks collected, including paper. Each item packaged separately.**
 - **if no, only items that could have foreign matter collected (underpants if vaginal/anal assault - possible drainage). Also obtain clothing from time of assault.**
- **selection of clothing items is case-dependent**



Sexual Assault Examination Kits - Documentation

- **lab should be provided with all necessary incident information**
 - last consensual intercourse
 - time from assault to collection of evidence
 - details of assault (penetration, ejaculation)
 - has clothing been changed/launched
 - activities of complainant between assault and examination
 - bleeding/menstruation
 - use of condom of other contraceptives
 - number of assailants
 - injury to assailant
- **evidence collection should be accurately and thoroughly documented**
 - list of exhibits collected
 - be clear as to what has been collected, from where it was collected and why it was collected (this is especially important with body swabs – is it possible semen or saliva? where on the body?)
- **we rely on this information to decide how to proceed with examinations!**



Sexual Assault Examination Kits - Additional Considerations

- don't forget swabs of areas with possible saliva (external genitalia, penis, breast, bite marks, etc)
- if swabs are to be analyzed for the presence of lubricants, the solvents used for lubricant extraction will destroy any DNA on the swabs



Detection of Semen - Challenges

- average ejaculate is 2-6mLs (average 3.5mLs)
- normal semen contains 100 million spermatozoa/mL
- oligospermic individuals - low sperm count
- azospermic individuals - no sperm (vasectomy & natural causes)
- Note:
 - identification of spermatozoa is necessary to confirm the presence of semen
 - semen samples without sperm may still generate a DNA typing profile



Detection of Semen - Challenges

- **increased time between assault and collection of samples limits the likelihood of finding foreign material in samples collected from the body**
- **persistence of spermatozoa in adults:**
 - oral - 2 to 6 hours
 - vaginal - 24 to 48 hours (8-12 motile)
 - cervix or higher - longer than vaginal
 - anal - 12 to 24 hours
 - body and clothing - until removed by washing
- **best chance of finding evidence is within 72 hours**



Detection of Semen - Challenges

- **DNA profiles have been obtained from laundered semen stains on clothing - essential that laboratory be informed if clothing has been laundered**
- **be aware that profiles obtained from the clothing of a sexually active female (especially the crotch area) may be from previous consensual intercourse (with suspect or other consensual partner)**
- **perhaps necessary to get a known reference sample from a consensual partner (for elimination purposes)**



Exhibits from Male Suspect

- penile swabs
- oral / lip swabs
- swabs of bite marks / saliva
- pubic hair combings
- foreign material/debris
- jewelry and body piercings
- swabs of fingers
- fingernail clippings/scrapings
- clothing (esp. underwear)
- voluntary known DNA sample or warrant sample



Exhibits from Scene

- condom
- objects used in assault
- bedding / furniture / carpet
- swabs of questioned stains
- weapons
- ligatures
- swabs of point of entry
- discarded clothing



Historical Sexual Assaults

Paternity testing

- known blood sample from complainant
- known blood sample from alleged father
- known blood sample from child

OR

fetal tissue from abortion/miscarriage



Toxicology Services - Sample Requirements

1) Blood:

- 2 tubes - grey stoppered vacutainers (sodium fluoride)
- if possible collect within 12 hours of assault (up to 24 hours)
- do not spin-down the blood

2) Urine:

- 3 tubes - grey stoppered vacutainers (sodium fluoride)
- if possible collect within 24 hours of assault (up to 36 hours)

Try to obtain immediately upon arrival at hospital



Toxicology Services – Pertinent Case Information

- **sex / age / height / weight of complainant**
 - for extrapolation of alcohol levels
- **time / date of incident**
- **last known meal / actions / known drinking and/or medications**
- **symptoms**
 - unconsciousness, blackouts, witnessed behaviour

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Thank you...any questions?



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