EVIDENCE HANDLING AND LABORATORY CAPABILITIES GUIDE FORENSIC BIOLOGY

CONTACT INFORMATION

If you have any questions concerning the Forensic Biology Laboratory examination capabilities or evidence handling procedures, please call the Forensic Training Section or the Forensic Biology Section at the Regional Laboratory that services your area.

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TABLE OF CONTENTS

OVERVIEW

When a biological substance, such as blood, semen, saliva, or tissue leaves the human body and is left at the scene of a crime, the biological sample will begin to degrade (break down; be destroyed) if not properly collected, packaged and preserved. In addition, due to the sensitivity of the DNA technology used by the Department of Forensic Science (DFS), if proper precautions are not taken while collecting evidentiary samples there is an increased possibility of introducing contamination from a foreign DNA source unrelated to the crime. It is also possible to transfer unrelated sources of DNA between crime scene samples if the evidence is not packaged or handled correctly.

PROCESSING OF EVIDENCE BY THE FORENSIC BIOLOGY SECTION

- The Forensic Biology examiner begins analysis by screening the evidence to identify the possible presence of a biological substance.
- Probative biological evidence selected via the screening process is analyzed using a DNA technology specifically designed to test 24 different genetic areas.
- The DNA profile obtained from the evidence is compared to the DNA profile from the known samples (victim, suspect or elimination samples, such as a husband or boyfriend) to determine if an individual is included or eliminated as a possible source of the biological substance.
- If no suspect has been identified, unaccounted for DNA profiles developed that meet certain criteria will be searched against the Virginia DNA Data Bank, which contains DNA profiles from convicted offenders and individuals arrested for specific felonies, to aid the law enforcement community to identify a possible perpetrator.

The types of cases analyzed by the Forensic Biology Section using DNA analysis include, but are not limited to:

- Homicides (includes attempted homicide, manslaughter and death investigations)
- Sexual Assaults (includes rape, anal sodomy, oral sodomy and cunnilingus)
- Criminal Paternity
- Breaking & Entering/Grand Larceny
- Robbery/Car Jacking
- Assault/Maiming/Malicious Wounding
- Missing Persons/Body Identification
- Miscellaneous (felony vandalism, arson, hit & run, illegal deer kills and sales, etc.)

GLOSSARY

- **Biological Substances** – Body fluids such as blood, seminal fluid, saliva, or urine or biological material such as tissue (muscle, fetal material, etc.) and feces.
- **Buccal sample –** A sample collected from the inner cheek of an individual's mouth to be analyzed as the individual's known DNA sample. Swabs are most commonly used to collect buccal samples. However, commercially available kits may also be used.
- **Blood sample** – Sample of an individual's blood taken by medical personnel.
- **Degradation** – Partial or complete deterioration of a biological substance by chemical or physical means (e.g., heat, moisture or bacteria) which can result in partial or no DNA results obtained.
- **Deoxyribonucleic Acid (DNA)** – The genetic material found in various body tissues (muscle, fetal tissue, skin, etc.) and body fluids (semen, vaginal fluid, blood, saliva, etc.). Because an individual's DNA is the same from cell-to-cell within the body and is different from individual- to-individual, DNA can be used to determine whether a biological substance may have been deposited by a specific individual. NOTE: Identical siblings (twins, triplets, etc.) usually have the same DNA profile.
- **DNA Profile** – The combined results that are developed when testing different areas of the DNA.
- **Mitochondrial DNA** – Small, circular DNA molecules located within cellular organelles called mitochondria. This type of DNA is inherited maternally. Mitochondrial DNA testing is conducted on samples (hairs with no root, bone, teeth, etc.) when nuclear DNA testing has not produced suitable results.
- **Nuclear DNA** – DNA found within the nucleus of most cells of the body. This DNA is inherited from both parents – half from mother and half from father. This is the DNA that is targeted most often during DNA analysis at the Department.
- **Physical Evidence Recovery Kit (PERK)** – Kits used for the recovery of physical evidence from the body of an alleged sexual assault or homicide victim or suspect. These kits are designed to aid in the recovery of foreign secretions and trace evidence (e.g., hairs and fibers) from the victim or suspect.
- **Semen** – A biological substance secreted by males that consists of a combination of seminal fluid and spermatozoa (the male reproductive cell).
- **Seminal Fluid** – A biological fluid produced by males in which spermatozoa, if present, reside.
- **Trace DNA Evidence** – "Trace" DNA evidence is evidence resulting from casual contact by an individual with a surface or material. This would include primarily objects touched by an individual's hand(s), such as keys, gun grips and triggers, knife handles, steering wheels, etc.
- **Virginia DNA Data Bank** – The Virginia DNA Data Bank is a collection of DNA profiles from convicted offenders and individuals arrested for certain felonies. A buccal sample is collected from these

individuals and a DNA profile is developed. The DNA profiles from these individuals are stored in the Data Bank for comparison purposes. In addition, the DNA Data Bank also contains DNA profiles obtained from evidence samples (from solved and unsolved cases) which may be compared in order to connect the DNA profiles from two or more unrelated cases to a common perpetrator. The Virginia DNA Data Bank is also linked to the National DNA Data Bank which contains DNA profiles from laboratories across the country. All profiles entered into the Virginia DNA Data Bank that are eligible for the National DNA Data Bank are automatically sent.

- **Wearer DNA** – DNA recovered from an article of clothing believed to have been deposited by an individual who wore the article of clothing. Areas on the clothing that can be tested include areas where the garment may have been in direct contact with the individual's skin.

- **Y-Chromosome DNA** – Male specific DNA found in the nucleus of most cells of the body. This type of DNA is inherited paternally. All paternally related males within a family (e.g., father, grandfather, brother, uncle, and cousin) will have the same Y-chromosome DNA profile, except where mutations occur.

CAPABILITIES AND SERVICES

The primary function of the Forensic Biology Section is to identify the possible presence of biological substances on an item of evidence and then determine whether the biological substance may have originated from a specific individual through the use of DNA analysis. Some cases involve Body Fluid Testing and DNA Testing, while others involve only DNA Testing.

SCREENING AND BODY FLUID TESTING

- **BLOOD CASES** – The screening and testing of evidence for possible presence of blood which is typically indicated by red/brown/tan staining on an item.

    - **Phenolphthalin Tetramethylbenzidine test (PTMB)** - Chemical tests to indicate the possible presence of blood. No blood confirmation testing is conducted.

    - **BLUESTAR® FORENSIC KIT** - Kit that can be used by law enforcement in instances where the blood may have been cleaned up from a certain area and is no longer visible to the naked eye.

        - If a positive BLUESTAR® result is obtained, the sample(s) must be collected and submitted to the laboratory if further biological substance determination is needed.

            - Information on purchasing this kit and the instructions for its use are available at www.bluestar-forensic.com.

            **NOTE: BLUESTAR® MAGNUM should not be used

- **SECRETION CASES** – These types of cases may include sexual assaults, breaking and entering, robberies, homicides, etc. that have items of evidence containing semen, saliva, perspiration, trace DNA, or wearer DNA samples.

- **Spermatozoa and/or seminal fluid**- Body Fluid Testing MAY include:
    - Chemical tests to indicate possible seminal fluid (confirmation requires identification of spermatozoa).
    - Microscopic identification of sperm cells (which confirms seminal fluid).
        - Sperm searching is at the examiner's discretion based on case scenario and case approach. If sperm identification is not addressed in the Certificate of Analysis, it was not conducted but can be requested by contacting the assigned examiner.
- **Examination for male DNA**
    - Utilized in sexual assault cases where the victim is female, and the assailant is male.
    - Body fluid testing for seminal fluid and microscopic identification of sperm cells is not routinely conducted.
    - The DNA quantitation system screens for the presence of male DNA.
- **Saliva** - Implied presence on envelope flaps, cigarette butts, bottles, cans, straws or body swabs from victim PERK. No Body Fluid Testing for saliva is conducted.
- **Vaginal fluid** - Implied presence of vaginal fluid on vaginal/cervical swabs, subject pubic area swabs, underpants and tampons. No Body Fluid Testing for vaginal fluid is conducted.
- **Trace DNA** - Implied presence of skin cells (for trace/wearer) on clothing and items that may have been handled by an individual. No Body Fluid Testing for Trace DNA is conducted.

- **BODY IDENTIFICATION CASES –** These cases involve the Office of the Chief Medical Examiner (OCME).
    - Law Enforcement Agencies (LEAs) will collect reference samples from first order biological relatives (biological mother, biological father, full biological sister – must share both parents, full biological brother – must share both parents) and provide those samples to the OCME.
    - The OCME then submits a sample collected from the deceased along with the reference sample(s) to the laboratory for DNA analysis and Kinship Statistics. This statistical calculation is conducted by a subset of examiners specifically trained to perform the calculation.
    - No Body Fluid Testing is typically conducted.
- **UNIDENTIFIED HUMAN REMAINS CASES –** These cases involve the analysis of blood, bones, hair, tissue, toenails, and/or teeth from unidentified human remains.

- The laboratory will develop a DNA profile for submission to the Virginia and National DNA Data Banks, and these profiles will be searched until the donor of the remains is identified.

- No Body Fluid Testing is typically conducted.

- **MISSING PERSONS CASES –** These cases involve the analysis of direct reference samples (e.g., tooth, hair) or personal effects (e.g., toothbrush) from a missing person.

  - Additionally, reference samples from biological relatives of a missing person can be submitted to aid in the search for missing family members.

  - DNA profiles will be developed and submitted to the Virginia and National DNA Data Banks. Profiles will be searched until the missing person is identified or located.

  - No Body Fluid Testing is typically conducted.

- **CRIMINAL PATERNITY/MATERNITY CASES –** These cases involve incest or rape in which the assault results in the birth of a child. The known blood or buccal samples from the victim, suspect, and child are submitted to the laboratory for DNA analysis.

  - DNA analysis can also be performed on fetal tissue obtained as a result of an abortion/miscarriage along with the samples from the victim and suspect.

  - If an individual cannot be eliminated as a possible biological parent of the child/fetal tissue, a Kinship Statistic will be conducted. This statistical calculation is conducted by a subset of examiners specifically trained to perform the calculation.

  - No Body Fluid Testing is typically conducted.

DNA TESTING

The purpose of DNA testing is to attempt to obtain a DNA profile from an item of evidence and compare it to the DNA profile from a known individual to determine if a specific individual may be the contributor of the biological material from the evidence item.

- Commercially available DNA typing kits are used to simultaneously test multiple genetic areas of the DNA to obtain the DNA profile.

- If the DNA profile from the evidence is consistent with the DNA profile from the known sample (i.e., a non-elimination), a statistical calculation will be performed to provide weight to the non-elimination.

- Types of DNA analysis include:
    - **Short Tandem Repeat (STR) DNA Analysis**
        - **Nuclear DNA Analysis** – DNA analysis is rooted in the principle that an individual inherits half of their DNA from their mother and half of their DNA from their father.
            - This is the most common type of DNA testing conducted in a case and is performed by all Forensic Biology examiners.
            - Allows the simultaneous analysis of 24 different genetic areas of the DNA.
            - A non-elimination will have a statistical calculation performed.
            - Profile may be eligible for submission to the Virginia DNA Data Bank or both the Virginia and National DNA Data Banks.
        - **Y-Chromosome DNA Analysis** – Y-chromosome DNA is paternally inherited (passed down directly from father to biological son).
            - Utilized in cases involving mixtures with a high ratio of female DNA to male DNA or in cases involving lineage testing such as body identification or paternity or missing persons cases when traditional nuclear DNA testing has not yielded a result.
            - Y-chromosome DNA testing involves the development of a DNA profile found only on the Y-chromosome that can be used for comparison to male reference samples.
            - Testing is conducted by a subset of examiners specifically trained to perform the analysis.
            - A non-elimination will have a statistical calculation performed.
            - Y-chromosome DNA profiles are not searchable against the Virginia or National DNA Data Bank; therefore, testing will not be conducted in cases without a known male suspect sample.
    - **DNA Sequencing**
        - **Mitochondrial DNA Testing** – Mitochondrial DNA is maternally inherited (passed down directly from mother to child).
            - Utilized in Missing Persons/Body Identification cases to improve the reliability of identifications and to aid serious felony investigations when other methods of DNA testing yielded limited to no results.

- Testing determines the linear order of the building blocks of the DNA molecule resulting in a "mitotype" which can be compared to reference sample "mitotypes".

- Testing is conducted by a subset of examiners specifically trained to perform the analysis.

VIRGINIA DNA DATA BANK

- If the DNA profile obtained from the evidence is unaccounted for (does not match the known sample from the suspect, victim, or other submitted known individual) or no suspect sample has been submitted for comparison, eligible DNA profile(s) obtained from the evidence that meet certain criteria will be searched against the Virginia DNA Data Bank to help identify the possible perpetrator of the crime.

  - Eligible profiles refer to the DNA profiles developed from crime scene evidence that can be attributed to the putative perpetrator(s) of the crime.

  - Profiles that may not be eligible for searching include certain mixture profiles (i.e., profiles containing DNA from more than one person) and partial profiles, and profiles developed from evidence collected from a suspect's possession.

- Profiles that meet additional, specific criteria and eligibility requirements will be submitted to the National DNA Data Bank for searching against profiles from other state and federal laboratories.

  NOTE: Samples collected from convicted offenders and arrestees in the Commonwealth of Virginia are analyzed by Data Bank analysts at the Central Laboratory. Forensic Biology examiners are **not** able to access these samples and use them for direct comparison purposes; therefore, it is always best, and eventually necessary, to submit a known sample from a suspect, even if the individual is in the Virginia Data Bank.

  NOTE: To see if an individual potentially associated with a case is in the DNA Data Bank, the electronic DNA Request form can be found at the following link: https://dfs.virginia.gov/laboratory-forensic-services/dna-databank/dna-request-form/

PROBABILISTIC GENOTYPING SOFTWARE

- DNA mixture profiles developed from evidence can be complex and may not be interpretable using traditional manual methods. In this instance, the Forensic Biology examiner may refer the mixture profile for probabilistic genotyping.

- Probabilistic genotyping refers to the use of biological modeling, statistical theory, computer algorithms, and probability distributions to calculate likelihood ratios and infer genotypes of a DNA profile.[1]

- This testing using the TrueAllele Casework System is conducted by a subset of Forensic Biology examiners specifically trained to perform the analysis at the Central Laboratory.

- This testing using the STRmix™ Casework System is conducted by a subset of examiners specifically trained to perform the analysis at each of the regional laboratories.

    - Notice of DFS Policy Change regarding STRmix™ Statistical Capabilities for DNA Mixtures

COLLECTION GUIDELINES

Biological fluids and body fluid stains are valuable evidence which can be used to either associate a victim or suspect with a crime/crime scene or eliminate them from consideration.

- The most frequently encountered biological fluids are blood, seminal fluid, and saliva.

- For the collection of blood for alcohol and/or drug analysis, refer to the instructions under Toxicology.

SAFETY PRECAUTIONS

Personal Protective Equipment (PPE) – this includes clean latex or nitrile gloves, shoe covers, gowns, masks, head covers, and safety glasses, as appropriate.

- All biological materials and fluids must be handled with universal precautions; therefore, when collecting or packaging biological evidence for submission to the laboratory it is IMPERATIVE that appropriate PPE be worn and changed often.
    - Body fluids, wet or dry, have been shown to carry diseases, so proper safety precautions must be observed.
    - Dry stains may flake when disturbed or collected, sending minute particles airborne which may be absorbed through mucus membranes (eyes, nose, mouth, etc.), open cuts, or chapped skin.
    - Wearing this protective clothing also helps minimize possible contamination of the evidence sample with your DNA.

GENERAL GUIDANCE FOR COLLECTION

- **AIR DRYING** – applicable evidence should be air-dried prior to submission to the laboratory.

    - When possible, the evidence (once packaged) should be submitted to the laboratory as soon as possible.

[1] Scientific Working Group on DNA Analysis Methods (SWGDAM) Guidelines for Validation of Probabilistic Genotyping Systems, 2015

        - Please refer to the Wet Evidence Collection Procedures for additional information.

    - If the evidence cannot be dried and submitted to the laboratory the same day as packaged, refrigerate the evidence until submission.

        - **Evidence should not be refrigerated for more than one week**.

        - **Please refer to Biological Evidence Preservation Handbook**: Best Practices for Evidence Handlers (NISTIR 7928) for additional information regarding storage conditions.

        - Refrigerating the evidence will slow bacterial growth but not stop it.

        - Bacteria can cause degradation of the biological material which can affect the lab's ability to obtain useful DNA results.

    - For an item of evidence, ensure that any stained area does not come in contact with any other stained or unstained areas (outer or inner surfaces) on the item.

        - For example, a shirt should not be folded or rolled so that a bloodstain on the front contaminates any stained or unstained area on the back or inside of the shirt.

            - A barrier, such as paper or cardboard should be placed on the inside of the shirt, as well as under and over the garment to prevent stained areas from coming in contact with each other (see Clothing in Paper Baffles).

    - When air drying articles stained with body fluids, place them on or over a piece of clean paper.

        - Any debris that falls from the material onto the paper during the drying process will be collected when the paper is folded with the article prior to packaging, labeling and sealing.

    - Ensure that stained areas do not come in contact with contaminated gloves.

- **CONTAMINATION PREVENTION** - Body fluid evidence can be contaminated by:

    - Exposure of the evidence item to the crime scene officer's own body fluids.

        - The perspiration on the officer's hands may contaminate the cotton swabs used to collect the body fluids.

        - To prevent such contamination, protective clothing (e.g., fresh latex or nitrile gloves, gowns, masks and head covers) should be worn while collecting the evidence.

    - Sample-to-sample contamination

        - Change latex or nitrile gloves (and other applicable protective wear) when contaminated and between items when collecting evidence.

COLLECTION PROCEDURES

WET EVIDENCE

Within a short period of time wet evidence stored in plastic, even if refrigerated, will promote bacterial and fungal (mold/mildew) growth, which can destroy biological material and potentially preclude the examiner from obtaining DNA results; therefore, air drying the evidence prior to packaging is preferred if possible.

- **Wet (saturated) Biological Evidence**

  Step 1: Package the item of evidence in plastic only if there is a danger of contamination due to saturation of wet items that cannot be air-dried prior to submission to the laboratory.

  Step 2: Indicate on the RFLE that the wet evidence is packaged in plastic and submit to the laboratory the same day, if possible. Otherwise refrigerate the evidence until it can be transported to the laboratory.

- **Wet Body Fluids on Non-Porous Surfaces (e.g., glass window, countertop, wood floor)**

  Step 1: Absorb the stain onto a sterile cotton swab(s), saturating one entire swab head before using another. Continue to swab the stain until the entire stain is absorbed or you have collected a maximum of four, well saturated swabs. Double-tipped swabs and Q-tips™ should not be used.

  Step 2: Place the swab(s) in a new swab box (labeled with location recovered) for drying.

  Step 3: Once the swab(s) in the box are dry, place the swab box in an envelope or other breathable packaging (e.g., brown paper bag, breathable evidence pouch) for submission.

  NOTE: Collection of wet body fluids in this manner assures that the best evidence is submitted in its most concentrated form. Any time water is added for collection, the chance of diluting the stain is increased.

- **Wet Body Fluids on Porous Surfaces (e.g., blanket, carpet, untreated wood)**

  Step 1: If an item of evidence is not excessively large, air-dry it and submit it to the Laboratory.

  OR

  Step 1: Cut out the stained area(s) or swab the stained area(s) with a sterile swab(s), concentrating the stain on the swab as much as possible.

  Step 2: Package the cuttings/swabbing from each area separately using a breathable container for each (e.g., swab(s) in swab box and then box in envelope, cutting wrapped in brown paper wrap and then placed in envelope, etc.).

- **<u>Fresh Human Tissue Sample (e.g., muscle tissue)</u>**

  Step 1: Package the item of evidence in plastic.

  Step 2: Indicate on the RFLE that the wet evidence is packaged in plastic and submit to the laboratory the same day, if possible. Otherwise refrigerate the evidence until it can be transported to the laboratory.

- **<u>Moist Partially Eaten Food Item (e.g., hamburger)</u>**

  Step 1: Swab the area on the food item that was bitten, where there may be possible contact between the perpetrator's mouth and the food item.

  OR

  Step 1: Package the item of evidence in plastic.

  Step 2: Indicate on the RFLE that the wet evidence is packaged in plastic and submit to the laboratory the same day, if possible. Otherwise refrigerate the evidence until it can be transported to the laboratory.

- **Partially eaten food that appears dry (e.g., old pizza crust)**

  Step 1: Proceed with the packaging used for Dry Evidence.

- **Aborted Fetal Tissue (10+ weeks old) Associated with Criminal Paternity Cases**

  Fetal tissue 10+ weeks old typically contains identifiable body characteristics (e.g., hands and feet) that can easily be isolated by the Forensic Biology examiner from the remaining aborted fetal/maternal tissue.

  Step 1: Request that the medical doctor performing the procedure place the entire aborted fetal material into a hard plastic container (e.g., specimen cup) or other appropriately sized container.

  Step 2: Submit the container to the laboratory the same day, if possible. Otherwise, place the container into a refrigerator or freezer and submit to the laboratory the next day.

- **Aborted Fetal Tissue (less than 10 weeks old) Associated with Criminal Paternity Cases**

  Typically, when fetal tissue is less than 10 weeks old, the body characteristics may not be easily identified by the examiner. Therefore, assistance from the medical doctor performing the procedure may be required to isolate the fetal tissue from the maternal tissue prior to submission to the laboratory.

  Step 1: Request that the medical doctor isolate a portion of the fetal tissue from the maternal tissue and place the fetal tissue into a hard plastic container (e.g., specimen cup).

  Step 2: Submit the container to the laboratory the same day, if possible. Otherwise, place the container into a refrigerator or freezer and submit to the laboratory the next day.

  NOTE: The fetal tissue/material should not be stored in a saline solution or any other type of preservative.

DRY EVIDENCE

- **Dried Body Fluids Stains (blood/semen) on Non-Porous Surfaces or Porous Surfaces -** Submit the entire air-dried item of evidence to the laboratory. If this is not possible (e.g., large carpets, upholstered furniture or fixed items such as a fence, sidewalk, etc.), either cut out the stained areas or take a swabbing of the stained area(s) and submit the swab(s) to the laboratory. Avoid scraping crusty material due to risk of airborne flakes.

  Step 1: Slightly moisten a sterile cotton swab(s) using one to two drops of distilled water. Double-tipped swabs and Q-tips should not be used.

  Step 2: Collect the stain ensuring that one swab is saturated with the stain before absorbing onto the next swab (maximum of 4 swabs recommended).

  Step 3: Allow the swabs to air dry or place them into a new, labeled swab box for drying.

Step 4: Once the swab(s) are dry, place in a swab box if not previously placed in one to dry and place the swab box in an envelope or other breathable packaging (e.g., brown paper bag, breathable evidence pouch) for submission.

- **Dried Body Fluids Stains (saliva/perspiration) and Trace DNA on Non-Porous Surfaces or Porous Surfaces (e.g., bottles, cans, triggers or grips of firearms)** – Whenever possible, use a single swab to collect the sample and submit the swab (not the item of evidence) to the laboratory. Avoid scraping crusty material due to risk of airborne flakes.

  Step 1: Slightly moisten a sterile cotton swab using one to two drops of distilled water. Double-tipped swabs and Q-tips should not be used.

  Step 2: Collect the stain/area of interest onto the swab. A single swab is recommended for sample collection on this type of evidence to concentrate the sample and to increase the likelihood of obtaining sufficient biological material to obtain a DNA profile.

  Step 3: Allow the swab to air dry or place it into a new, labeled swab box for drying.

  Step 4: Once the swab is dry, place in a swab box if not previously placed in one to dry and place the swab box in an envelope or other breathable packaging (e.g., brown paper bag, breathable evidence pouch) for submission.

Additional notes for Trace DNA samples:

- By swabbing an item of evidence, such as the mouth of a bottle or areas of a firearm that are of no value for latent print examination (e.g., textured grips), the swab(s) can be submitted to the Forensic Biology Section while the actual item of evidence can be submitted for examination to the Latent Print or Firearms Sections, as applicable.
  - If uncertain where to collect the swabbing, it is best to contact the laboratory for guidance.
- Trace DNA samples MUST be collected prior to forensic examinations in other sections such as latent prints or firearm exams. If the item has been examined by another section, and trace DNA samples were not collected prior, it is no longer suitable for trace DNA collection.
- Refer to the Notice of DFS Policy Change regarding "Trace" DNA evidence.

BODY FLUID EVIDENCE NOT READILY VISIBLE

- **Biological substances that are not blood (e.g., seminal fluid)**: At certain wavelengths of light, body fluids may emit light (fluoresce); therefore, an Alternate Light Source (ALS) may be used to locate a body fluid which can then be collected and submitted to the laboratory. For example, seminal fluid stains on automobile seats and floors may not be readily visible to the naked eye but may be enhanced by using an ALS. Certain chemicals (such as food and detergents) can mimic body fluid stains under certain lighting conditions. Eye protection should be used with ALS. Types of ALS include:

- Ultraviolet (UV) light - short wave and long wave UV light do not require the use of a filter. Short wave UV light is emitted at 245 nm and long wave UV light is emitted at 366 nm.
    - Long term exposure of DNA to UV light can cause degradation.
- Other Commercially Available Alternate Light Sources: fluorescence of body fluids is best at 450 nm; a yellow filter should be used.

  Step 1: Hold the ALS over a particular item of evidence with a suspected body fluid and look for an emittance of light (fluorescence).

  Step 2: Collect the area of fluorescence onto a swab(s) or cut the area out, as per previous instructions for Dry Evidence.

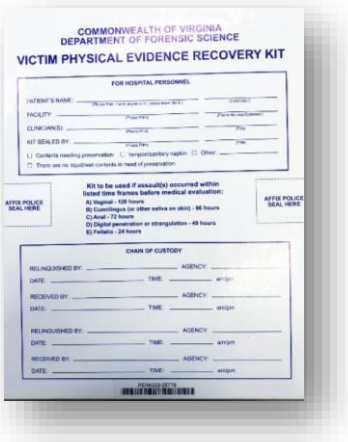
- **BLUESTAR® FORENSIC KIT for blood stains:** When blood from a crime scene or item of evidence has been cleaned up, residual blood may remain which cannot be seen in natural light. This kit can be used to visualize these traces of blood. The BLUESTAR® reagent is a chemiluminescent compound which reacts with blood and emits light in a dark environment. This reagent can react with other substances such as metals and bleach.

  Step 1: Spray the item with the BLUESTAR® solution in the dark. Do not over saturate the suspected stained area, otherwise the BLUESTAR® solution will dilute the possible blood stain.

  Step 2: When the luminescence appears, collect the area onto a swab **OR** if submitting the actual item, make a wide circle around the area with a permanent marker where luminescence was seen taking care not to contaminate the positive area with ink.

  Step 3: Allow the evidence item or swab to air dry and submit it to the laboratory to test for the possible presence of blood in the sample.

  Step 4: Photograph the luminescence (if desired) with SLR camera equipment by using long (30 second minimum) exposure times and an aperture setting around f8 while the camera is mounted on a tripod. The exposure times will vary based on the strength of the reaction. Collect any visible stains BEFORE attempting any photography. The BLUESTAR® reagent must be reapplied to the affected area during the extended exposure time.


COMMONWEALTH OF VIRGINIA
DEPARTMENT OF FORENSIC SCIENCE
VICTIM PHYSICAL EVIDENCE RECOVERY KIT
FOR HOSPITAL PERSONNEL
CHAIN OF CUSTODY

SEXUAL ASSAULT EVIDENCE

- **Victim Physical Evidence Recovery Kit (VPERK)** – A kit (white box) used for the recovery of physical evidence from the body of an alleged sexual assault victim. Modifications to this kit are made for the collection of evidence from children and male victims.

What is included in the kit? Supplies used to recover secretions from various areas of a victim's body, as well as victim known samples (blood or buccal sample and pubic area combings) and underpants worn during or immediately following the alleged assault.

- **Where can the kit be acquired by law enforcement and hospitals?** Kits are available at all DFS laboratories.

- **When is a PERK collected?** For use within 5 days of the alleged assault. Medical personnel are urged to follow the instructions supplied with the kit. See attached link for collection time frames for specific types of offenses.

  - Notice of policy change "Revisions to Collection Time Periods for Physical Evidence Recovery Kit (PERK) Samples" for collection time frames for specific types of offenses.

- **What is the purpose of testing a PERK?** To determine if any foreign DNA is present and compare those DNA profiles to any relevant known samples submitted in the case or potentially search in the Virginia DNA Data Bank.

- **How is the PERK submitted to the laboratory?**

Step 1: The kit should be sealed and initialed by the examining clinician/doctor and initialed by the officer receiving the PERK. Do not open or air-dry the contents.

Step 2: Submit the PERK to DFS following the guidelines set forth in §19.2-11.8. If the kit is in an Evidence Transfer Bag, do not seal the bag for submission since the items inside have already been sealed.

Step 3: Collect and submit underpants worn during and/or immediately after the assault if the examining clinician did not include them in the PERK (please refer to the following section for specifics pertaining to underpants).

NOTE: Any other additional items, such as clothing/bedding, collected outside of the PERK should be retained by the agency. The submission of these items will require a case submission consultation with the laboratory.

- **Sexual Assault Victim's Underpants** – Submit underpants worn during and/or immediately after the assault if the examining clinician did not include them in the PERK. The underpants worn by the victim immediately after the assault will likely collect vaginal drainage, which may include seminal fluid, saliva, and/or hairs/fibers left by the suspect.

Step 1: Specifically ask if the underpants worn by the victim to the hospital are the same ones worn immediately after the assault. If not, it may be necessary to locate and collect them.

Step 2: Package the collected underpants in paper to facilitate drying and submit to the laboratory along with the PERK.

NOTE: Other victim clothing items ***may*** be submitted on a case-by-case basis. Please contact the laboratory for a case submission consultation prior to submission.

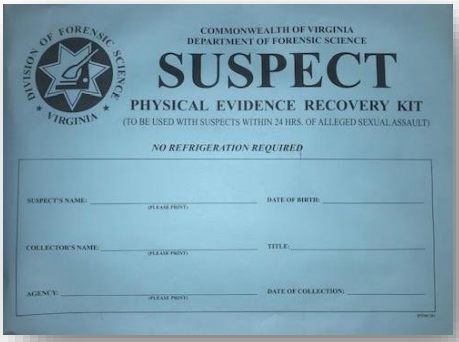
Example - If no underpants were worn by the victim immediately after the assault, but other clothing items (such as blue jeans or shorts) that were in contact with the genital area were worn, these items may be submitted upon approval of the submission by the laboratory.

Example - Other victim clothing items may be submitted based on case scenario (e.g., an external ejaculation) upon approval of the submission by the laboratory.

- **Suspect Physical Evidence Recovery Kit (SPERK)** – A kit (blue envelope) to aid the recovery of physical evidence from the body of a sexual assault suspect for comparison with foreign secretions and hairs recovered from the victim. This kit is for use within 24 hours of the offense. Collection personnel are urged to follow the instructions supplied with the kit.

    - **What is included in the kit?** Supplies used to recover foreign secretions and trace evidence (e.g., hairs and fibers) from the suspect's body (e.g., pubic area swabs and/or finger swabs) as well as suspect known samples (blood or buccal sample and pubic area combings) and underpants worn during or immediately following the assault.

      NOTE: For **digital penetration cases**, use 1 or 2 swabs to ***collectively*** swab the fingers from each hand and place the samples from each hand in a separate, labeled swab box. **Do not collect a separate swabbing from each finger.**



NOTE: The submission of a suspect PERK is not subject to the same guidelines as those set forth for victim PERK in §19.2-11.8.

- **Sexual Assault Suspect's Clothing** – Because secretions (e.g., vaginal fluid, saliva associated with fellatio), hairs, fibers, and/or other materials may be found on the suspect's clothing which may associate the suspect with the victim and/or the crime scene, collect the suspect's clothing which was worn during the assault.

Step 1: Have the suspect stand on a large, clean sheet of paper while disrobing to collect any possible trace evidence (e.g., hairs or fibers).

Step 2: Package the collected clothing in paper to facilitate drying and store for possible future submission to the laboratory.

NOTE: Suspect clothing items ***may*** be submitted on a case-by-case basis. Please contact the laboratory for a case submission consultation prior to submission.

- **Physical Evidence from Sexual Assault Scene** – The assault scene may contain body fluid and/or hairs/fibers from the victim and/or suspect. This becomes especially important if the victim has washed/cleansed themselves after the assault. Please consult with the lab prior to the submission of these items of evidence.

    - **Bedding** – If the assault occurred on a bed, collect the top surface of the bed linen or swab any observed secretions. For both collection types, utilize the steps outlined in Wet/Dry Evidence Collection, as appropriate.

NOTE: Bedding can be submitted in the absence of a PERK; however, if a PERK has been collected, the bedding should not be submitted to the laboratory until the PERK has been evaluated and the laboratory is consulted.

- **Vehicle/furniture** - If the assault occurred in a vehicle or on another surface such as furniture, either collect the actual fabric where secretions are seen or swab the secretions. For both collection types, utilize steps outlined in Wet/Dry Evidence Collection, as appropriate.

- **Towels/tissues** – If towels or tissues are used by the suspect or victim to clean up after the assault, utilize the steps outlined in Wet/Dry Evidence Collection, as appropriate.

  NOTE: If an item has been washed, it may still contain trace and/or biological evidence; therefore, this evidence should still be collected for possible examination if other evidence yields no probative information.

- **Condoms (wet):**

  Step 1: Place wet condom into a plastic bag or container (e.g., specimen collection jar) and indicate on the RFLE that the evidence is wet.

  Step 2: Submit to the laboratory the same day as collection, if possible. If submission the same day is not an option, refrigerate the condom and submit it to the laboratory as soon as possible.

- **Condoms (dry):** Package in paper and submit to the laboratory. Ensure the RFLE reflects that the condom is DRY.

KNOWN BLOOD/BUCCAL SWAB SAMPLES

It is strongly encouraged that the victim and suspect known samples, as well as any elimination samples be collected and submitted to the laboratory for comparison with submitted evidentiary samples. In the instance of a sexual assault, the assault may not be reported immediately; therefore, it is imperative that the time interval since the assault occurred be determined to ensure the correct kit is used for the collection of the samples.

- **Victim PERK:** Will contain either a blood stain card (blood is air dried onto a blood stain card by examining clinician) or buccal swabs (swabs from inner cheek of the mouth collected by the examining clinician).

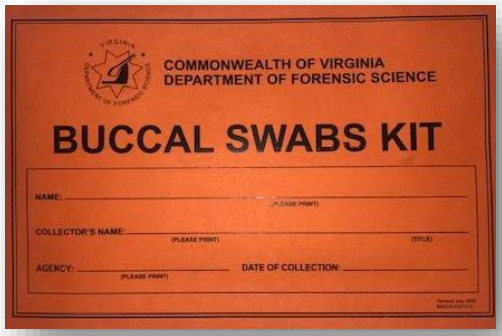
  NOTE: If a known blood sample is collected in a lavender top EDTA vacutainer tube and not dried to a stain card, it must be refrigerated and submitted to the laboratory as soon as possible.

- **Toxicology samples:** Blood and urine for alcohol and/or drug analysis will be collected by the examining clinician separately from the known victim blood contained within the PERK. These samples should be collected according to the instructions under Evidence Handling & Laboratory Capabilities Guide for Toxicology and refrigerated until they are submitted.

- A buccal or blood sample from an individual should be collected separately for Forensic Biology analysis.

- **<u>Buccal Swabs Kit:</u>** This kit (orange envelope) can be used for the collection of a known DNA sample from a victim, suspect, or third party for elimination purposes. The instructions supplied with the Buccal Swabs Kit should be followed for collection.

  NOTE: This kit may be used under the following specified circumstances:



  - SUSPECT – when the collection of known samples takes place more than 24 hours after a sexual assault or for cases not involving a sexual assault.

  - VICTIM - when the collection of known samples takes places more than 5 days after a sexual assault or for cases not involving a sexual assault.

  - THIRD PARTY - when an individual (e.g., husband or boyfriend) unrelated to the crime may have contributed biological substances to the evidence.

  Step 1: Swab the inner cheek of the mouth with **two** (2) sterile swabs, rotating them during the collection process to ensure the swabs have been saturated with saliva and buccal cheek cells.

  Step 2: Place **both** swabs together into **one** (1) new swab box labeled with the individual's name to air dry.

SUBMISSION GUIDELINES

GENERAL REMINDERS

- Submit only the most probative item(s) of evidence to the laboratory. If necessary, additional items of evidence can be submitted at a later date.

  Example - The first submission in a sexual assault case should contain only the victim PERK and appropriate standards. Additional evidence such as clothing and bedding can be submitted later depending on the initial results obtained.

  - Please contact the assigned Forensic Biology examiner or a supervisor regarding additional submissions for guidance or suggestions.

- The Forensic Biology Section no longer analyzes control swabs, therefore there is no need to collect or submit the control swabs to the laboratory.

- Large submissions:

- Prior to a submission of many items, a Forensic Biology examiner/supervisor must be contacted via telephone, email or through an in-person meeting to identify the most probative evidence for the case. Evidence submission will be limited to those items.
    - Determination of probative evidence will be decided based on a number of factors including the type of case, the evidence collected, the number of victims and perpetrators, etc.
    - In the event that additional evidence submission is necessary, communication between the assigned examiner and the investigator will occur to facilitate this process and the examination of the subsequent submission in a timely manner.

- Shared evidence between Forensic Biology and other sections (Firearms, Latent Prints or Controlled Substances)
    - Each section has different turnaround times. If evidence is shared between the Forensic Biology Section and other sections, please consider swabbing the evidence prior to submission to minimize the impact that the Forensic Biology Section turnaround time will have on the turnaround times for the other sections.
        - If the evidence is swabbed prior to submission, the evidence can be directly submitted to the other sections. The swab(s) from the evidence can be submitted separately to the Forensic Biology Section.
        - If the evidence is not swabbed prior to submission, the evidence needs to be examined by the Forensic Biology Section before the transfer to other sections to begin analysis.
            - Please refer to the Case Statistics Dashboard for the backlog and average days in system for each section.

- Cold case
    - Prior to submitting evidence from a "cold case", please consult with the Forensic Biology Section examiner who performed the original analysis, if possible, or a supervisor to determine which items of evidence should be submitted to the laboratory.

REMINDERS FOR DIFFERENT TYPES OF CASES

- Stolen property (including stolen vehicles)
    - Please indicate the scenario on the RFLE to aid the Forensic Biology examiner to determine whether the DNA profile developed from the evidence meets the criteria to be searched against the Virginia DNA Data bank such as, but is not limited to, the following:
        - Where was the item collected from?
        - Did this item belong to the victim? Who owns this item?

        - Was the item left by the offender?
        - Please refer to the Virginia DNA Data Bank for additional information.
    - For cases where the offender touched or used an item belonging to the owner of the stolen property or someone unrelated to the crime, it is strongly recommended that a known sample from the owner or the unrelated individual be submitted for elimination purposes.
        - Refer to the Notice of DFS Policy Change regarding "Trace" DNA evidence.
- Sex offenses
    - Depending on the case scenario, it may be imperative that all appropriate known samples (e.g., victim, suspect, elimination samples - such as the husband or boyfriend) are submitted to the laboratory.
        - The Forensic Biology examiner may reach out in cases where the known samples are needed. Please respond even if a known sample cannot or will not be collected at this time.

          Example – A Victim PERK was not collected, and only the victim's clothing was available for submission. It is imperative that a buccal or blood sample from the victim be submitted for elimination and interpretation purposes. In this specific situation, the DNA mixture profile developed from the victim's clothing may contain the victim's DNA. It may be possible to separate the foreign DNA profile for comparison or possible searching in the DNA Data Bank.
    - If a PERK was not collected because it exceeded the relevant collection time period, please note so on the RFLE.

TRACE DNA SUBMISSION POLICY FLOW CHART