nfstc
SCIENCE SERVING JUSTICE

Biological Screening Workshop

Crime Scene and Case Processing

Crime Scene and Case Processing

- **Includes:**
  - **Types of evidence**
  - **Crime scenes**
  - **Location and collection of evidence**
  - **Collection techniques**
  - **Preservation of evidence**
  - **Packaging and storage**
  - **Documentation – Chain of Custody**
  - **Casework analysis**

Biological Screening Workshop

Evidence Handling

- **No evidence handling guide can address every conceivable scenario, nor is this intended to supersede policies and procedures that a laboratory may already have established, but to serve as a general overview of evidence collection and handling**
- **It is designed to supplement instruction provided by your local forensic laboratory**

Biological Screening Workshop

Types of Evidence

- **Testimonial Evidence – statements of those involved**
  - **Victims, suspects, witnesses**
  - **Subjective in nature**
- **Physical Evidence – any tangible object that can connect an offender to a crime scene, an offender to a victim, a victim to a crime scene, etc.**
  - **Objective in nature**
  - **More reliable than testimonial when documented, collected and preserved properly**

Biological Screening Workshop

Physical Evidence

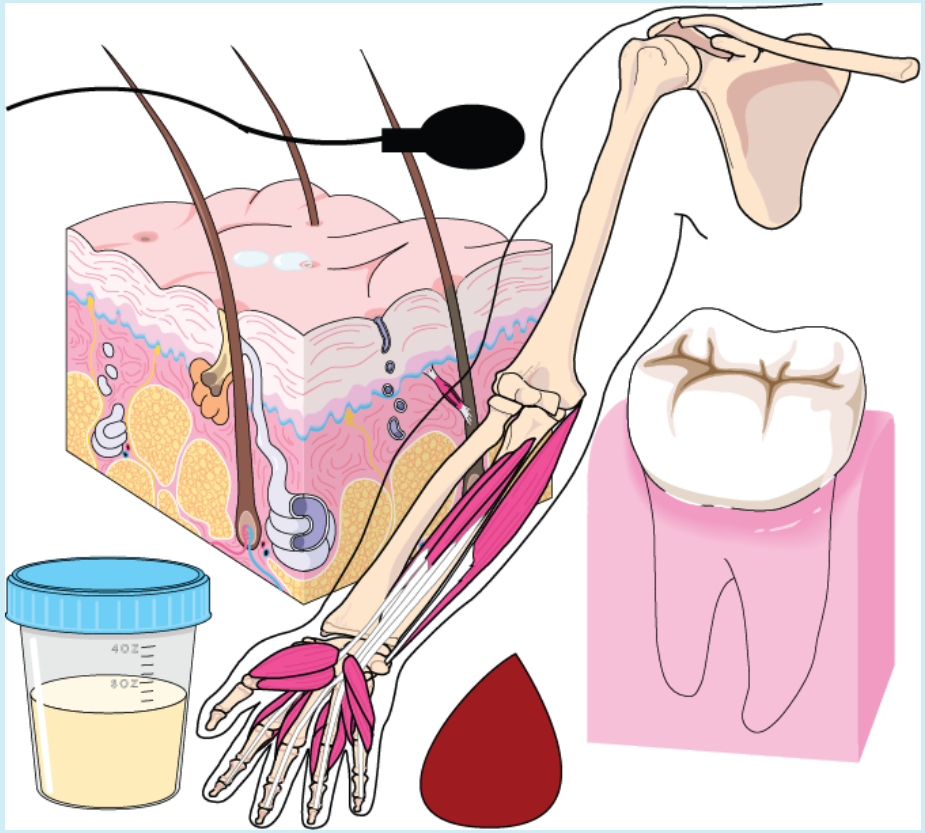
- **Locard's Exchange Principle - with every contact there is a transfer of material**
- **Often referred to as the "silent witness"**
- **Careful and thorough collection and preservation of physical evidence is essential**
- **Types of physical evidence – biological material, prints, hairs & fibers, paint chips, impression evidence and fracture patterns**
  - **Not always visible to the naked eye**

Biological Screening Workshop

nfstc
SCIENCE SERVING JUSTICE

Sources of Biological Evidence

- **Blood**
- **Semen**
- **Saliva**
- **Urine/Feces**
- **Hair**
- **Teeth/Bone**
- **Tissue**
- **Cells**



Biological Screening Workshop

nfstc
SCIENCE SERVING JUSTICE

Types of Crime Scenes

- **Outdoor**
- **Indoor**
- **Conveyance**

Biological Screening Workshop

Outdoor Crime Scenes

- **Most vulnerable to loss, contamination and deleterious change of physical evidence in a short time**
- **Individuals can alter, destroy or contaminate evidence**
- **Things that can cause deterioration of evidence**
  - **Heat, cold, rain, snow and wind**
- **Imperative to properly secure**

Biological Screening Workshop

Outdoor Crime Scenes

- **Night time outdoor scenes present additional problems or concerns**
  - **Lack of light can lead to inadvertently destroying or missing evidence**
  - **If possible secure scene and process during daylight**

Biological Screening Workshop

Indoor Crime Scenes

- **Less susceptible to loss, contamination and deleterious change**
- **Challenges for indoor crime scenes**
  - **Sometimes difficult to determine which areas are pertinent**
    - **For example, was the entire house involved or just the living room?**
  - **Can be cluttered making it difficult to focus on or isolate evidence**
- **Easier to protect and preserve**

Biological Screening Workshop

Scenes of Conveyance

- **Conveyance – something that serves as a means of transportation**
  - **Vehicle burglary**
  - **Grand theft**
  - **Homicide**

Biological Screening Workshop

Scenes of Conveyance

- **Key to recognize evidence can extend well beyond the conveyance**
  - **Flight path of suspect may lead to tire or shoe impressions**
  - **Cigarette butts**
  - **Clothing items left in or around conveyance or flight path**

Biological Screening Workshop

Location of Evidence at the Scene

- **The key to proper location is to obtain and document as much information as possible prior to entering scene**
  - **Smells – bleach or cleaning agent?**
  - **Lights – on /off?**
- **Tools used for location of evidence**
  - **Visual observation**
  - **Alternate light source**
  - **Luminol or other tests**

Biological Screening Workshop

Location of Evidence at the Scene

- **Once located, evidence must be properly documented, collected and preserved to prevent contamination, loss and deleterious change**
- **Investigator should prioritize order evidence is collected**
  - **Biological evidence, trace evidence and fragile evidence collected FIRST**
- **Collection methods to gather and package this evidence may vary**

Biological Screening Workshop

Location of Evidence in the Lab

- **Visual observation**
- **Many body fluids fluoresce using alternate light sources**
- **Lighted magnifiers may assist in locating stains**
- **Microscopic evaluation can aid in locating small stains**
- **Mapping and/or general swabbing techniques can aid in locating body fluid stains**

Biological Screening Workshop

Contamination – Sample Handling

- One option is to wear double gloves and change the top pair often
  - Between each item of evidence
  - After touching your face, nose, etc.
- Masks, if necessary
  - Protects evidence from excessive talking, sneezing or coughing
- Hair net
- Eye protection
- Shoe covers and gowns, if necessary

Biological Screening Workshop

Contamination – Sample Handling

- **Personal Protective Equipment (PPE) is essential to protect against cross-contamination**
- **Disposable gloves – powder free**
  - **Powder can fluoresce and inhibit PCR**
  - **Perspiration from collector's hands**
  - **Change gloves each time a new piece of evidence is handled**

Biological Screening Workshop

Actions to Avoid

- **Touching any areas or items where DNA may exist**
- **Touching your face, nose, hair, and mouth when collecting and packaging evidence**
- **Sneezing, coughing, excessive talking near evidence**
  - **Gloves and/or masks should be changed if contaminated**

Biological Screening Workshop

Evidence Collection

- **Proper evidence collection is aimed at:**
  - **Avoiding contamination**
  - **Ensuring safety and health of personnel**
  - **Preservation of the evidence**

Biological Screening Workshop

Protect the Evidence

- **Prevent Contamination**
- **Preserve evidence with proper packaging**
- **Proper storage**
- **Use appropriate labels**
  - **Biohazard labels**

Biological Screening Workshop

Evidence

- **You should:**
  - **Clean utensils appropriately**
  - **Use disposables when you can**
  - **Package samples separately**
  - **Air dry samples PRIOR to packaging**
  - **Keep reference samples separate from question samples**
  - **Use distilled water**
  - **Aliquot water if possible**

Biological Screening Workshop

Evidence

- **You should NOT:**
  - **Allow contact between drying items**
  - **Expose items to heat or humidity**
  - **Contaminate your water**
  - **Use too much water**
  - **Use staples**
  - **Package in plastic**
    - **UNLESS ITEMS ARE DRY**
    - **Better to use paper bags or envelopes if not fully dry to prevent mold or bacterial growth**

Biological Screening Workshop

Collection of Biological Evidence

- **Use disposable tools if possible**
  - **Scalpels, tweezers, scissors, spatulas**
- **Clean non-disposable tools prior to the collection of each item**
- **If disposable instruments are not used:**
  - **Clean with 10% bleach solution**
  - **Rinse with sterile water or alcohol**
  - **Thoroughly dry**

Biological Screening Workshop

Collection of Sharp Objects

- **For safety reasons package evidence such as knives in small cardboard boxes or other rigid containers**
- **Package items to limit movement within the container**

Biological Screening Workshop

Documentation

- **Never collect evidence without first documenting the location, conditions, etc.**
- **Sketches, photographs, detailed notes**

Biological Screening Workshop

Collection Techniques

- **Wet absorption**
  - **Sterile swab lightly moistened with deionized water**
  - **Concentrate stain in a localized area**
  - **Air dry**
  - **May follow with a dry swab to ensure thorough collection (double swab technique)**
- **Cuttings**
  - **Remove with sterile or clean cutting device**
- **Scraping**
  - **Clean utensil or razor**
  - **Scrape into clean paper**
  - **Fold and package**

Biological Screening Workshop nfstc SCIENCE SERVING JUSTICE

General Sample Collection

- **Package each stain or swab separately**
- **DO NOT combine stains**
- **Label multiple swabs from the same stain accordingly**

Biological Screening Workshop

Hard Smooth Surfaces

- **Immobile Objects – Car doors, window ledges, tile floors, etc.**
- **Collect onto a sterile cotton swab**
- **Scrape onto paper using a sterile scalpel**
  - **Collect a control (optional)**
  - **Package separately**

Biological Screening Workshop

Soft Porous Surfaces

- **Wood, carpeting, upholstery**
- **Cut the stain from the object**
  - **Collect a control (optional)**
  - **Package separately**

Biological Screening Workshop

Proper Seals

- **Use tamper resistant tape**
  - **DO NOT seal evidence with**
    - **Staples**
      - **Risk of injury and sample contamination when handling or unpackaging**
    - **Glue**
    - **Paper clips**
    - **Scotch tape**
- **The seal should be marked with your initials or other appropriate identifier**

Biological Screening Workshop

Evidence Handling

- **The fewer people who handle evidence, the better**
  - **Decreases chance of contamination**
  - **Assists in court admissibility hearing**

Biological Screening Workshop

Biological Evidence – Storage and Transportation

- **Many laboratory systems store dried biological evidence at room temperature**
- **Items which have body fluids on hard smooth surfaces such as metal or glass should be stored at room temperature**

Biological Screening Workshop

Biological Evidence – Storage and Transportation

- **Metal or glass tends to 'sweat' when taken out of the freezer/refrigerator which could cause the body fluid to 'sweat' off onto the packaging**
- **The degradation of body fluids is retarded when stored frozen, however studies have shown that under appropriate conditions room temperature is okay**

Biological Screening Workshop

Chain of Custody

- **A record of individuals who have had physical possession of the evidence**
- **Critical in maintaining the integrity of the evidence**
- **If DNA analysis results in a foreign DNA type, it may be necessary to identify persons who handled the evidence**

Biological Screening Workshop

Chain of Custody Components

- **Identifiers that describe the evidence at the time it was found**
  - **Location**
  - **Position**
  - **Date and time of collection**
- **Packaging or sealing information**

Biological Screening Workshop

Evidence Documentation

- **Examine package for seals, tampering**
- **Mark evidence according to your lab policy**
  - **May include case number, exhibit number, date, initials**
- **Note:**
  - **Conditions (seals)**
    - **For example, one sealed brown paper bag (sbpg)**

Biological Screening Workshop

Evidence Documentation

- **Open evidence with scissors or knife**
  - **Try not to cut through existing seals, if possible**
  - **If this is not possible, it is advisable to document this in the case file**
- **Document the package contents**
  - **If there are multiple layers of packaging, all should be documented and marked appropriately**
  - **When possible, mark the evidence with appropriate identifier**

Biological Screening Workshop

Evidence Documentation

- **Analyst notes should be sufficient so that the item of evidence can be identified at a later time**
  - **Interviews**
  - **Testimony**

Biological Screening Workshop

Evidence Documentation

- **The description should contain sufficient detail**
  - **A shirt may be described as:**
    - **"Red button up long sleeve shirt, with a tear on the front right arm wearing. Several stained areas visible on the front left side wearing. One button missing from front pocket."**
    - **Digital images will assist in item descriptions, save time and enhance the case file**

Biological Screening Workshop

Evidence Screening

- **Prior to screening**
  - **Remove hairs and debris to debris fold**
  - **Possible evidence for later analysis**
  - **Document in notes**

Biological Screening Workshop

Blood

- **Looking for blood:**
  - **Perform visual exam**
    - **May use a flashlight, illuminated magnifier or microscope**
  - **Mark stained areas**
    - **Blood appears different on different substrates**
    - **Not always red**
    - **Environmental factors can play role – degraded, old may look different**

Biological Screening Workshop

Blood

- **Test marked stains, as appropriate – indicate result on item and notes**
  - **May choose to take a digital image and mark those areas tested on the image**

Biological Screening Workshop

Blood

- **If all marked stains result in negative results, analyst may use mapping or general swabbing technique**
  - **Section off item**
  - **Take general swabbings from each section**
  - **Test all general swabbings**
- **If any stain is POSITIVE**
  - **Document and remove portion for DNA testing**
    - **Picture, diagram**

Biological Screening Workshop

Dried Small Blood Spatters

- **Collect with cotton swab**
  - **Collect control (optional)**
  - **Package separately**

Biological Screening Workshop

Packaging of Trace Evidence

- **Package in paper; DO NOT use plastic**
  - **Evidence can stick to the plastic packaging from static**
- **Collect so that you minimize loss or contamination**
  - **Hairs**
  - **Loose fibers**
  - **Paint chips**
  - **Soil**
  - **Gunshot residue**

Biological Screening Workshop

Packaging

- **Label each item with a unique identifier**
  - **Department record number**
  - **Unique item number**
  - **Collector's initials**
  - **Date and time**
  - **Description**
- **Place evidence into new paper bags, not plastic bags to prevent degradation**

Biological Screening Workshop

Sexual Assault Kits

- **Common items:**
  - **Vaginal swabs**
  - **Cervical swabs**
  - **Anal swabs**
  - **Oral swabs**
  - **Smears**
  - **Fingernail scrapings**

Biological Screening Workshop

Semen – Alternate Light Source (ALS)

- Screening tool
- Semen visualized using 400 to 500 nm wavelength with orange safety goggles
- Perform in dark room
- Mark areas of fluorescence

- Semen fluoresces due to:
  - Pseudomonis fluorescens – bacteria contain fluorophores
  - Flavins
- Fluorophores excited by energy source (light) emit light energy and are visible

Biological Screening Workshop

Sexual Assault Kits

- **Optional ALS exam**
- **Screen swabs with Acid Phosphatase test**
- **Do microscopic exam on the swabs**
  - **Even if negative – possible breakdown of proteins by body, sperm may survive**
- **Oral swabs**
  - **Oral assaults not always reported**
  - **Don't treat as a standard until tested for semen**

Biological Screening Workshop

Sexual Assault Kits

- **If Acid Phosphatase POSITIVE and Microscopic exam NEGATIVE**
  - **Perform Prostate Specific Antigen P30 test**
- **Causes of Acid Phosphatase POSITIVE and Microscopic exam NEGATIVE**
  - **Vasectomized**
  - **Low sperm count**
  - **Aspermic**
  - **No sex occurred**
  - **False positive Acid Phosphatase test**

Biological Screening Workshop

Sexual Assault Kits

- **Causes of Acid Phosphatase NEGATIVE and Microscopic exam POSITIVE**
  - **Breakdown of Acid Phosphatase (water soluble)**
    - **Environmental factors**
      - **Heat**
      - **Humidity**
      - **bacteria**
  - **Time**

Biological Screening Workshop

Sexual Assault Kits

- **Juvenile sexual assaults**
  - **Assailants may use saliva as lubricant on juveniles**
  - **May want to perform amylase test on swabs (not oral)**
  - **Some labs send the samples → DNA (no amylase test)**

Biological Screening Workshop

Semen

- **Exam for semen on evidence (not swabs)**
- **Perform visual exam and mark visual stains**
- **Perform exam with Alternate Light Source (ALS)**

Biological Screening Workshop

Semen

- **Take representative cuttings from marked areas**
  - **Visible and fluorescent stains**
- **Test Acid Phosphatase (+) stains for Microscopic exam or Prostate Specific Antigen p30**
  - **Panties – may want to perform Microscopic exam even if Acid Phosphatase NEGATIVE (like swabs)**
  - **Depending on case scenario can perform Microscopic exam on Acid Phosphatase NEGATIVE samples**

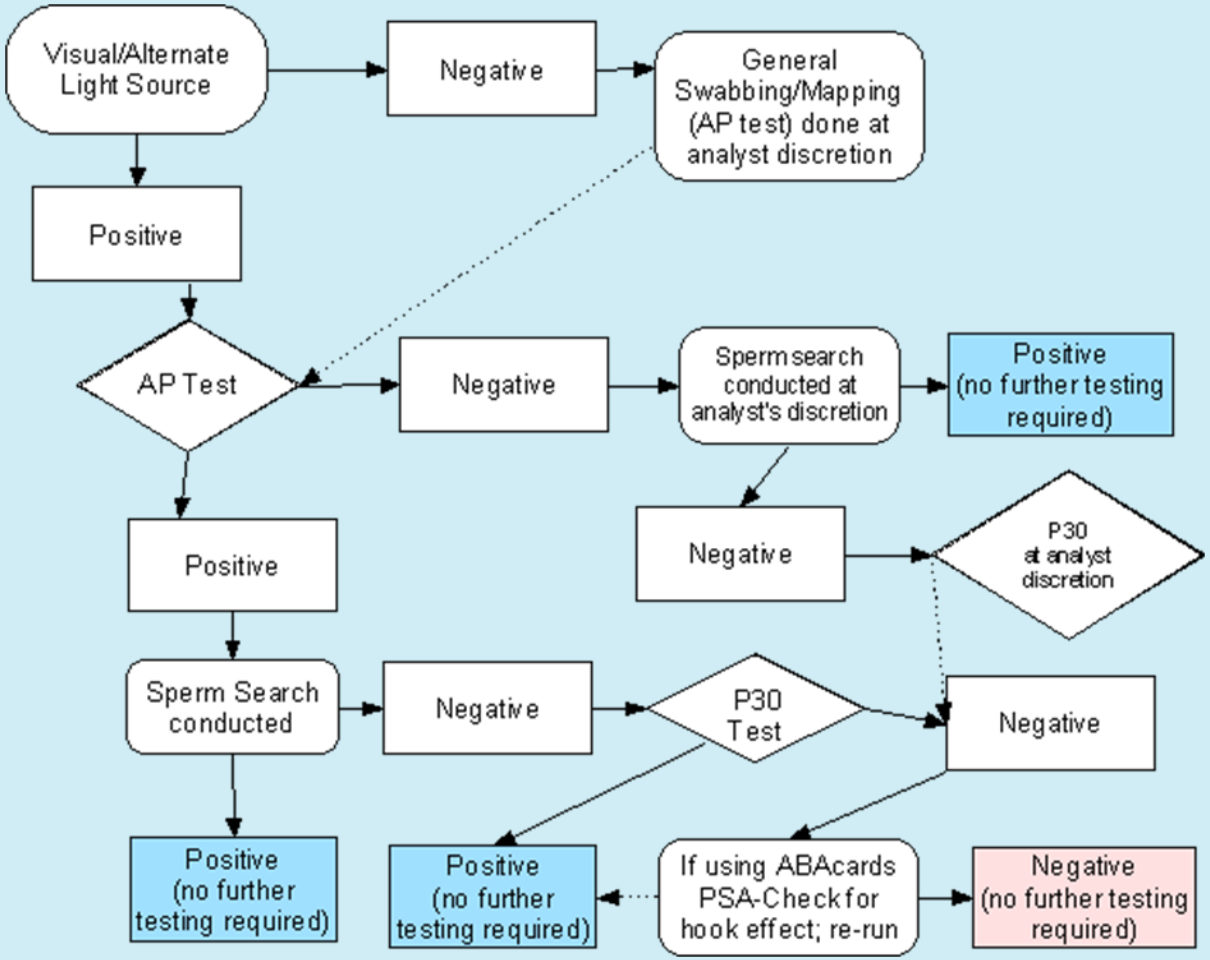
Biological Screening Workshop

Semen

- **Body breaks down water soluble proteins**
- **Semen stain on cloth – snapshot in time, unless environmental factors (humidity, etc.)**
- **Document and remove positive areas for DNA testing**

Biological Screening Workshop

Testing Workflow for Semen



Biological Screening Workshop

nfstc
SCIENCE SERVING JUSTICE

Sexual Assault Cases

- **Important to know previous sexual encounters**
  - **Consensual partners**
- **Need to request elimination standard from consensual partners**
- **Used to determine if evidence came from victim, suspect or someone else**

Biological Screening Workshop

Saliva Evidence

- **Items of Interest**
  - **Masks (robberies)**
  - **Bitemarks**
  - **Stamps and envelopes**

Biological Screening Workshop

Saliva

- **Most common cases: burglaries, juvenile sex assaults, assaults (bite marks)**
- **Mark visual stains**
- **Screen with ALS**
- **Mark areas of fluorescence**
- **Take representative cuttings or swabbings to extract for amylase test of choice**
- **Positive areas – document and remove for DNA testing**

Biological Screening Workshop

Multi-section Cases

- **Many items need to go through other sections of the lab**
- **Common requests**
  - **Latent prints**
  - **Trace or microanalysis**
  - **Firearms**

Biological Screening Workshop

Multi-section Cases

- **Latent Prints**
  - **Important to talk to detective to find out what they are looking for**
  - **If need both serology *and* latent prints you should do serology *first*, if possible**
  - **You can have latent examiner present if you are worried about destroying prints**
    - **If available**

Biological Screening Workshop

Multi-section Cases

- **Trace or microanalysis:**
  - **Talk to detective about what they are looking for on evidence**
  - **If microanalysis is necessary – should be swept first *before* you open for testing**
  - **Prevents transfer from you to evidence (hair, fibers) or loss of trace evidence**

Biological Screening Workshop

Multi-section Cases

- **Firearms:**
  - **Serology tests do not typically interfere with firearms analysis**
  - **Talk to detective**
  - **You should have evidence first to prevent contamination if possible**
    - **If firearms examiners handle before you – should wear gloves**
  - **Serial number restoration uses chemicals which may affect stains**

Biological Screening Workshop

Multi-section Cases

- **Firearms:**
  - **Sometimes cases need "touch" evidence on guns, bullets**
  - **Important that the evidence is protected**
  - **Swab first for DNA before handled by other sections, if possible**

Biological Screening Workshop

Multi-section Cases

- **Storage:**
  - **Be aware of storage policies for other sections**
    - **Do not store blood on glass or guns in freezer**

Biological Screening Workshop

Multi-section Cases

- **Important to know limitations and functions of other sections**
- **Talk with detectives**
  - **For example, sometimes they have to pick – latent print analysis or serology**

Biological Screening Workshop

Reference Samples

- **Blood**
  - **avoid blood transfusions**
- **Buccal swabs/saliva**
- **Clothing**
  - **Last resort secondary standard**
- **Other secondary standards**
  - **Toothbrush, hairbrush, glasses, etc.**
- **Other standards**
  - **All persons who had access to a crime scene should be documented**
  - **May be necessary to collect samples from these individuals**

Biological Screening Workshop

Burglary

- **All persons who had access to a crime scene should be documented**
- **May be necessary to collect samples from these individuals**

Biological Screening Workshop

Hair Evidence

- **Types of testing available**
  - **Comparative**
    - **Physical and chemical characteristics**
    - **Human origin**
  - **DNA**
    - **Nuclear (STR DNA Analysis) – with root only!**
    - **MtDNA – if no root**

Biological Screening Workshop

Touch Evidence

- **Epithelial cells that have been transferred from the person to the evidence via "touching"**
- **These samples tend to have low amounts of DNA**
- **Would expect body fluid stains to have more DNA than touch evidence**
- **Body fluid comparison:**
  - **Undiluted semen (with sperm) stain > blood stain**
  - **Both blood and semen > saliva stain**
  - **Body fluids > wear area stain (armpits, collar of a shirt)**

Biological Screening Workshop nfstc SCIENCE SERVING JUSTICE

Questions?

Biological Screening Workshop

nfstc
SCIENCE SERVING JUSTICE