



American Association of Tissue Banks®



**Guide to
Medical Examiner & Coroner Cases**

Guide to Medical Examiner & Coroner Cases

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Background & Objective

Many potential donors of organs, tissues, and eyes begin under medicolegal jurisdiction and require release before donation can occur. Although many death investigators support donation, much is at stake when evaluating a medicolegal case for release. Victims, their families, alleged perpetrators, prosecution and defense attorneys, and law enforcement agencies are all seeking the truth in the assessment of cause and manner of death. Death investigators are committed to performing the very best investigation possible to find the cause and manner of death. If the death investigators do not have a positive relationship with those in the donation community it can affect their willingness to allow donation on medicolegal cases. If organs, tissues, or eyes are lost, this can affect the lives of many of those waiting for life-enhancing or life-saving donations. To overcome this potential disconnect, education and communication are necessary on both sides. Information and education are powerful; however, if they cannot be properly communicated, then the knowledge is lost.

A lack of standard procedures, training, or practices promoting the preservation of evidence can all be contributing factors to death investigator decline of donation. Despite the essential role death investigator relationships have on donation, national guidance or training material has not been developed for the donation community. While much emphasis has been placed on death investigators' support of donation, there has been little focus given to how the donation community may support the medicolegal death investigation process.

The American Association of Tissue Banks and the Eye Bank Association of America recognize the critical role that death investigators play in donation. This document has been developed to provide examples of beneficial practices and case studies that illustrate how such practices have been successfully utilized in tissue and eye donation cases under death investigator jurisdiction.

These practices are not requirements or standards, but were developed to inform the donation community about practices which may beneficially serve the donor, donor family, and recipient by establishing measures to improve interactions on cases shared by death investigators and recovery organizations. Practices, policies, and procedures should be developed by each individual recovery organization in collaboration with the medicolegal death investigation offices in their service area.

Defining Donation Stakeholders

Throughout this document organ, tissue, and eye organizations will be referred to generally as **recovery organization(s)**. These organizations may handle all areas of organ, tissue, and eye recovery and donation or may handle specific roles in their designated areas of donation.

What is Medicolegal Death Investigation?

A medicolegal death investigation is the evaluation of the circumstances and possible causes which lead to the determination of the cause and manner of death of an individual. The investigation may include, but is not limited to, photographs, reports, medical records, physical examination of the decedent, interviews with surviving family members and/or witnesses, the collection of evidence, and testing and screening of anatomical specimens.

Who Is a Member of the Medicolegal Death Investigation Community?

It is important to understand the requirements, jurisdiction, and titles of the medicolegal death investigators in your region, county, state, and service area. Many individuals, such as coroners or medical examiners may have similar or identical roles with interchangeable titles depending on the location and jurisdiction. Throughout this document the coroner, medical examiner, and forensic pathologist will be referred to uniformly as **Death Investigators**.

A **coroner** (C) is generally an elected (sometimes appointed) official whose duty is to oversee medicolegal death investigations, usually for a single county, and certify cause and manner of death.

A **forensic pathologist** (FP) is a physician who is certified in forensic pathology by the American Board of Pathology (ABP) or who, prior to 2006, has completed a training program in forensic pathology that is accredited by the Accreditation Council on Graduate Medical Education or its international equivalent or has been officially “qualified for examination” in forensic pathology by the ABP. May be employed as a medical examiner or as a consultant to a coroner of Justice of the Peace.

A **medical examiner** (ME), is an appointed forensic pathologist whose duty is to oversee medicolegal death investigations, perform postmortem examinations, and certify cause and manner of death.

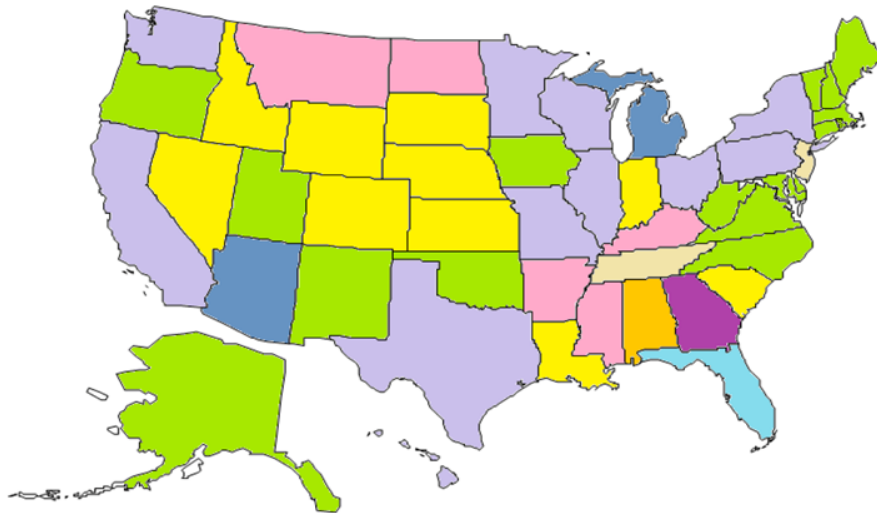
In some states, a medical examiner or coroner (ME/C) may handle all medicolegal death investigations up to the requirement or circumstances which require an autopsy. The autopsy may then be completed at a regional autopsy center or by a third-party forensic pathologist. This may be referred to as a regional system.

Medicolegal death investigation professionals (MLDI) are often trained on the job; however, there are death investigation courses available in the United States to assist jurisdictions with training new investigators. Following training, investigators can seek to become nationally certified. One organization offering certification is the American Board of Medicolegal Death Investigators (ABMDI). Investigators may seek to become certified independently while many coroner/medical examiner jurisdictions require that all new investigators become ABMDI certified within a certain period of time after being hired. Whether certified as a Diplomate (D-ABMDI) or a Fellow (F-ABMDI), certification demonstrates that a medicolegal death investigator meets minimum competence in the investigation of deaths according to commonly accepted standards.

State & Regional Death Investigation Systems

Practices, jurisdictions, and systems differ on a state-by-state and in some cases on a regional basis within each state. Practices, policies, and procedures for each individual recovery organization should be established within and include guidance from this designated state or regional criteria. Depending on the jurisdiction, deaths are investigated under a coroner, medical examiner, or mixed system model. The map above shows that while this model seems simple at first glance, there are a variety of combinations of the medical examiner/coroner system throughout the country which can make certain jurisdictions appear more complicated. For example, it is possible that in a jurisdiction with an elected coroner, a board-certified forensic pathologist may be hired to conduct autopsies

Death Investigation Systems: 2014



- Some counties have a medical examiner and many or most have a coroner.
- State Medical Examiner with coroners in each county
- State Medical Examiner with various types of non-coroner regional or local assistance
- State Medical Examiner assisting coroners in most counties, at least one autonomous county medical examiner
- District Medical Examiners (FL). ● Mostly state-funded district offices assisting coroners in most counties (AL).
- Medical Examiner (physician) in each county.
- Coroner in each county
- Regional offices administratively (but not operationally) overseen by person with title of State Medical Examiner (NJ, TN)

*Courtesy of Randy Hanzlick, MD

under the supervision of the coroner. It is also possible that a forensic pathologist may choose to run for elected coroner in another jurisdiction, thereby ensuring that the coroner position is staffed by an individual with extensive training in forensic pathology and death investigation.

Communication & Relationship Management

Clear communication and proactive relationship management is at the heart of effective coordination of donation cases where a death investigator is involved. This section describes best practices implemented in many different areas in the United States where the death investigator works successfully with their local recovery organization(s). Communication, as described in this section, encompasses both case-by-case communication as well as structured communication pathways developed to support timely and efficient problem-solving in complicated situations.

Relationship management cannot be discussed without mentioning the topic of trust. Since medicolegal death investigation offices and recovery organizations both have critical responsibilities which have implications for both the death investigation and the support of public health, mutual collaboration cannot be successful without trust. Each office needs to be able to trust the other office to perform their role responsibly. The Scientific Working Group for Medicolegal Death Investigation (SWGMDI) even goes so far in their standards document to differentiate between standards, guidelines, and best practices. The following guidelines outline ways in which roles and

responsibilities can be proactively created, thus building trust through the establishment of clear and concise performance practices.



Contracts & Agreements

Business relationships that require timely and effective communication between offices are often best managed by agreed upon standards and requirements. Although the methods for documenting such agreements vary greatly on a national level, there are some typical best practices that have been employed successfully. These include interoffice *memoranda of understanding* (MOU), *letters of agreement* (LOA), or contracts that support the statutory requirements of the local city and/or county for both medicolegal death investigation and donation.

A *memorandum of understanding* may be the simplest and most effective way to generate a document that meets the needs of both offices. While not an official contract, an MOU can succinctly outline mutually agreed upon practices. In addition, an MOU is easier to update when needed improvements come to light during the management of cases and decedent-related situations over time. In an effort to help medical examiners' offices, the National Association of Medical Examiners (NAME) ad hoc Committee on Organ and Tissue Donation has created a repository of sample MOU documents for member only reference on their website.

Letters of agreement are similar to MOU documents, but they are formatted to be closer to the structure of a contract and are commonplace in business agreements. They can be structured in a way to outline agreed upon practices.

Official contracts are sometimes used to manage interoffice business relationships and are the most formal way to capture agreed upon guidelines. A contract is advantageous since it will capture the signatures of key leadership professionals in each office to ensure that guidelines outlined in the document are mutually beneficial. Contracts are also typically used in situations where there is fiduciary responsibility of one or both of the parties in the contract. For example, the local statutes for coroner may require that the office have a contract with local recovery organizations and require that a recovery organization pay a specified fee for the case-by-case or monthly use of a dedicated recovery room within the ME/C autopsy facility. Since the environmental requirements for successful tissue recovery are key to an aseptic recovery, a contract can also specify which party in the contract is responsible for the repair and upkeep of the recovery room used by the recovery organization. The contract may specify when and how often payment is rendered to the county and under what conditions. While all three examples given so far can include a *sunset clause*, thus allowing a document to get reviewed and reevaluated within a specified time period (e.g., every 1–3 years), a contract is most likely to contain such a clause.

While it may be helpful to list all of the areas any of these three documents could govern, doing so is beyond the scope of this guide. The needs of recovery organizations and medicolegal death investigation offices can vary greatly. Therefore, it is imperative that each office determine how to best meet one another's needs and document an agreement accordingly.

Standard Operating Procedures

The use of standard operating procedures (SOPs) is not new to the functioning of a successful recovery organization and the use of such resources should not be overlooked when working with a medicolegal death investigation office. As you will see in this guide, there are many details that must be attended to on each donor case and having procedures to outline these requirements is key. While there will be similar content that could apply to procedures written by different recovery organizations (e.g., handling of decedent personal belongings, handling of potential evidence, when to contact the death investigator on call), each medicolegal death investigation office and recovery organization may want to handle these situations in a customized manner according to business needs as well as local and national statutes and regulations.

◆◆◆ Case Study ◆◆◆

A 37-year-old male with a history of alcohol dependency was found dead at the bottom of the stairs leading to his garden level apartment. The weather was cold, snow was on the ground, and there was some question as to the cause and manner of death. At the time of screening, it was unclear whether the decedent fell and died as a result of a head injury, foul-play, or hypothermia. Given the circumstances, the chief medical examiner was consulted. The chief medical examiner told the death investigator on the case to release for the recovery of skin grafts and musculoskeletal tissue after an external examination and prior to the autopsy (also called a *post* or *post-mortem*). As agreed upon in the interoffice MOU, the death investigator completed the release form and sent it to the established fax line at the recovery organization. The release form documented which tissues were released and, more importantly, which tissues could not be recovered prior to autopsy (e.g., heart for valves, lower leg blood vessels). The form also documented the number and color of blood vacutainers requested by the death investigator to be left with the decedent for toxicological analysis. The next day, the death investigator called their point of contact at the recovery organization and asked why only grey-top vacutainers were left with the decedent. The recovery organization manager opened the case and reviewed the release document faxed over by the death investigator and saw that red-top vacutainers were also requested. It was determined that the recovery organization staff on the case assumed that this office only wanted grey-top vacutainers and did not reference the agreed upon release document. Corrective action and counseling of recovery organization staff was conducted and the problem was resolved for future shared cases, thereby reestablishing trust between the two organizations.

Effective Communication

One of the most important and effective best practices that your recovery organization can implement is one that Dr. Charles V. Wetli used during his tenure at the Suffolk County Medical Examiner's Office in New York. In a mutual agreement between the recovery organizations and medicolegal death investigation office, a single point of contact at each organization was established for situations where problems were identified. This effectively removed any confusion or trepidation

on the part of the medicolegal death investigation office regarding whom to contact and how to communicate the issue.

A commonplace situation that may occur on routine donation cases is when something unexplainable or suspicious is found during the physical assessment performed by the recovery organization. This is especially problematic if the finding is subtle or questionable and may be related to the cause and/or manner of death. The commonly accepted protocol is to stop the donation process and contact the death investigator. This practice is important enough that the National Association of Medical Examiners (NAME) position paper on the release of organs and tissues for transplantation states the following: “The recovery team should stop the procedure and contact the ME/C if unexpected findings are encountered.”

Blood sample acquisition provides an excellent opportunity to communicate and cooperate with a death investigator on a shared case. Routine cases are typically not an issue, as blood can be drawn either intravascularly by the recovery organization prior to autopsy or by the pathologist if the autopsy precedes the recovery. Problems arise in situations where a potential donor is plasma diluted and a pre-mortem hospital sample must be acquired for testing. As the death investigator has jurisdiction, the recovery organization will need to collaborate with them to potentially share or split pre-mortem samples in order to proceed with donation. This is ideal as it allows both agencies to meet their separate needs, as this permits the death investigator to run toxicological testing and the recovery organization to run serological testing.

Interoffice communication can take place at any point during the management of a case and need not be limited to the time of the referral. The medicolegal death investigation office can provide the recovery organization’s medical director with information that may be critical in determining donor eligibility, which can ultimately lead to the discard or release of the recovered tissues. While it may seem as though recovery organizations are more likely to consume information provided by the medicolegal death investigation office, recovery organizations can reciprocate and share critical information that can assist a death investigator with the certification of cause and manner of death.

Routine Communication

Once agreements, protocols, and customer service tools have been implemented, there are still opportunities to engage in communication. Regularly scheduled meetings, may be mutually beneficial. In these scheduled meetings, outcomes, statistics, and overarching feedback can be provided and discussed by the recovery organization and medicolegal death investigation office. Routine communication can also be related to the request and receipt of completed or preliminary autopsy reports, which are needed in order to finalize donor eligibility determination and release for tissue processing and distribution.

Donor Referral Systems

As death scene pronouncements do not commonly result in the decedent being transported to a hospital morgue and medicolegal death investigation offices are not required to notify recovery

organizations of deaths, these cases may not be referred to the recovery organization. Developing a death referral agreement between the recovery organization and medicolegal death investigation office may promote the opportunity for donation in the case of deaths which otherwise may have not been reported to the recovery organization.

Several recovery organizations and medicolegal death investigation offices have established automated electronic referral programs to streamline this process and reduce the risk of human error. Exploration of these referral programs may be beneficial if the opportunity exists.

◆◆ Case Study ◆◆

A 54-year-old woman was found dead in bed by family members in the morning. The death investigator arrived onsite to conduct the investigation and the family members left the residence shortly after being interviewed by the death investigator. The death investigator contacted the recovery organization to refer the case. Due to training conducted in his office, he followed the checklist in his investigative folder and remembered to document the whereabouts of the family after they left the residence. He notified the family that they may receive a call related to donation. The recovery organization called the telephone number provided by the death investigator and the recovery organization was able to successfully complete a donor authorization and DRAI. The recovery was successfully completed on the same day, between the external examination and post-mortem examination of the decedent.

Educational Opportunities

Educational opportunities can be placed in two categories: initial training and ongoing training. Initial training can involve the onboarding of both death investigators and recovery organization staff by their respective offices about procedures, forms, and guidelines. Ongoing training can take place in many different situations. Monthly or quarterly meetings and office sponsored skills days provide opportunities for learning. It may be helpful to give the medicolegal death investigation office the opportunity to interface with critical recovery organization staff on a regular basis. Opportunities for orientation and training can be, but are not limited to:

- Recovery organization staff observing post-mortem examinations
- Recovery organization staff obtaining continuing education credits by participating in local or regional death investigation courses, a practice supported by both AATB and EBAA
- Recovery organization staff to participating in *ride along* investigations with medicolegal death investigators for that office
- Recovery organization staff to attending a local or regional medical examiner's or coroner's association meeting to network and learn about common issues associated with donation
- Recovery organization staff to taking a tour of the medicolegal death investigation office in order to understand the different aspects of medicolegal investigation including: toxicology, autopsy document release, family viewing areas, and decedent arrival/departure storage protocols

- Death investigation staff witnessing the donor screening, authorization, and DRAI interviews
- Death investigation staff being introduced to current clinical applications of organs, tissues, and eyes. Presentations may even be coordinated in cooperation with all local recovery organizations to cover all clinical applications in one presentation
- Death investigation staff attending a recovery case with an experienced and knowledgeable team/person. It is commonly recommended that anyone who views a recovery procedure be required to see the entire process, in order to ensure that the viewer sees the level of care and attention given to proper anatomical reconstruction/restoration

Requesting Release for Donation

Recovery organizations are oftentimes requesting permission from the death investigator to proceed with the established wishes of the decedent. The death investigator may be accurately viewed as the gatekeeper for access to donor tissues due to the fact that local statutes grant the medicolegal death investigation office legal custody over a decedent as evidence. In most states, if the medicolegal death investigator feels that the removal of specific organs or tissues would jeopardize the medical and legal determination of the cause and/or manner of death, they have the right to restrict donation either entirely or partially.

Many recovery organizations and medicolegal death investigation offices have preestablished methods and procedures for requesting release for donation and exchanging relevant information for each case. Many requests have become automated by sharing case log input or similar medical databases. It is imperative that all relevant information and case details be shared so that accurate decisions can be made. The death investigator is more likely to grant permission for donation if the recovery organization can paint a comprehensive picture of a decedent's circumstances of death and the possible causes of death/injury/hospitalization. When the circumstances are known and clearly communicated to the medicolegal death investigation office, they may be more comfortable releasing for donation without having the organs, tissues, or eyes present for autopsy or external examination.

When the circumstances surrounding a death are unknown and/or puzzling, there can be hesitation on the part of the death investigator to release for donation, as any possible clues that may be within or on the body may be lost or go unnoticed by the recovery organization. The fear of missing something vital to the determination of cause and manner of death may lead a death investigator to deny donation of such tissues until after autopsy.

At times, decision-making with respect to releasing tissues for donation can be based on the potential application of the tissue. Transplantable organs, tissues, and corneas that are life-saving and/or life-enhancing, are commonly released by the death investigator. A medicolegal death investigation office may be less likely to release in cases where organs, tissues, and corneas/eyes are only acceptable for medical research, as they are not utilized directly in patient care or therapy.

Recovery and Evidence Preservation

Efforts should be made to limit and mitigate additional manipulation or alteration of anatomical findings during recovery, as the body may contain clues that can help confirm or clarify the

circumstances around the manner and/or cause of death. For example, the recovery of pelvic tissue may cause disruption of abdominal findings or breach the peritoneum. The rupture of the bladder during recovery eliminates the option for post-mortem urine collection, which may be essential for toxicological testing by the death investigator.

Documentation

Documentation of relevant physical findings, medical record findings, case-related communication with the death investigator, a decedent's personal effects, and disposition may be considered evidence and be beneficial to the death investigator. Documentation should be descriptive but not overly prescriptive, as diagnosing injuries or findings may be inaccurate and/or contradict the diagnosis of the death investigator.

Communication

Documentation of critical communication between the death investigator and the recovery organization is not only required to maintain real-time donor record management, but may be discoverable in a court of law or subpoenaed. Details that are documented surrounding death investigator's release for donation, such as restrictions and requests, should be uniform and standard practices should be developed for individual offices in collaboration with appropriate death investigators. Information documented should include the first and last names of the persons contacted, as well as their title. The dates and times of these conversations should also be captured. Documenting method of contact can also be helpful (e.g., phone, text, email).

Cooling

Documentation of cooling times is not only essential for completing the donor record, but may also be relevant to the death investigation. A lack of cooling can result in expedited decomposition and may impact findings. Therefore, detailed records of cooling timelines may be beneficial in diagnosing the onset of injury or identifying various post-mortem changes.

Identification

Documentation of decedent identification is essential in retaining the integrity of the chain of custody. As the decedent is under death investigator jurisdiction, granting permission to recover prior to the viewing/external examination/autopsy places the responsibility of maintaining the chain of custody on the recovery organization. This includes ensuring the traceability and location of all evidence and the decedent.

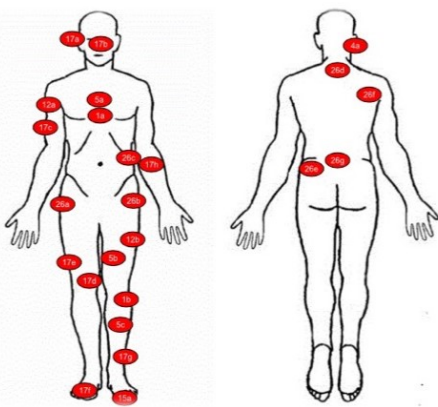


Medical Record Findings

Medical records may be considered evidence and should be treated as equal importance as physical findings. Abnormal findings, diagnostic outcomes, and suspicion of active viral infections or communicable diseases should be relayed to the death investigator expeditiously. Signs of chronic comorbidities or diagnosis by a clinician directly related to the cause of death, or contributing to the cause of death, should also be relayed in an urgent manner.

◆◆◆ Case Study ◆◆◆

A 36-year-old male was admitted to the emergency room after suffering an apparent cardiac event with no prior medical history. He died in the cardiac intensive care unit (ICU) several days after admission. Due to the sudden nature of the death in combination with the decedent's young age, the case was under death investigator jurisdiction. Although the family gave authorization for donation and completed a DRAI, the death investigator was hesitant to release for donation. Upon further evaluation of the medical records, diagnoses of cardiomegaly, hypertension, and severe cardiopulmonary insufficiency were noted. This information was relayed to the death investigator, who then declined further death investigation, as the case was now considered a natural death.



Documentation of Physical Assessment Findings

All physical assessment findings should be documented in detail to ensure that there is a record of relevant or discoverable findings. This may include the identification of injuries, abnormalities, or *pertinent negatives* (the absence of outstanding or expected findings). This practice is essential to the proper completion of donor records and may also be essential to the death investigation. Detailed record keeping also provides historical reference points in the event that an inquiry is made at a later time.

Documentation should remain descriptive, but not prescriptive or diagnostic, in nature. Identification of injuries and/or lesions (e.g., abrasions, contusions, lacerations, blood clots) should include the location of the finding and the estimated size.

It should be noted that there are differing perspectives on whether a recovery organization should document exact measurements of physical findings. While it is considered more accurate to measure a wound, scar, or other finding, there is a possibility that the death investigator will also measure the same findings. In the event that the physical assessment and autopsy measurements contradict one another, it may call into question which measurement is correct. It is most likely the measurement on the autopsy report will stand as a death investigator has more experience and training in the proper measurement of physical findings. This can be avoided by providing approximate measurements of physical findings, such as comparing the size to another well known object (e.g., round lesion approximately the size of a quarter). Such documentation should also be maintained throughout the tissue recovery. The location, description, and size of abnormal intraoperative findings should be detailed in a descriptive, but non-prescriptive, or diagnostic manner.



Apparent small laceration, roughly 2" superolateral to the right tibial tuberosity. Photo: Craig Nelson, MD

Documenting Significant Ocular Exam Findings

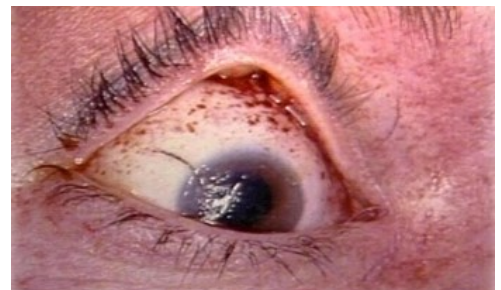
Ocular examination performed by the eye bank may yield information pertinent to the medicolegal examination and/or eye donor eligibility. Once the eye bank performs a procedure (e.g., in situ excision or enucleation), the condition of the eyes will change. Observations noted during the pre-recovery ocular examination may include systemic (e.g., jaundice, sarcoidosis), local (e.g., petechial hemorrhages, pterygium, infiltrates, melanoma), surgical (e.g., previous cornea transplant, LASIK or other cornea re-shaping procedures, glaucoma tube shunt, iridectomy), traumatic (e.g. laceration, abrasion), or circumstantial (e.g. dirt, glass, debris) findings. The significance of observations to the each involved party varies by case. For instance, an observation of a corneal transplant or prosthetic eye has relatively obvious implications for the eye bank, but may also be useful to the death investigator to assist in the identification process.



Icterus, also known as scleral jaundice.

Jaundice is usually an indicator that there is an issue with a person's liver, gallbladder, or pancreas. This can be attributed to a variety of factors, which include cirrhosis, heart failure, hepatitis, sickle-cell anemia, acute pancreatitis, and carcinomas. Because it is possible to see jaundice in the ocular tissue only, it is important to document as a finding for the death investigator.

Petechial hemorrhages are small red or purple pinprick size dots of blood that appear under the skin or mucous membranes. Two of the main causes are trauma and excessive pressure (e.g., vomiting, strangulation, violent coughing). Asphyxiation, accidental or intentional, may often result in the presence of petechial hemorrhaging of the face or conjunctiva, which is significant to the death investigation.



Petechiae due to strangulation.

It is important for the eye bank recovery technician to note if contact lenses were present in the donor's eyes from both an investigative and chain of custody perspective.

◆◆ Case Study ◆◆

A family of four and delivery truck driver for a furniture company were involved in a motor vehicle accident. A member of the family of four and the delivery truck driver were killed in the accident and both became eye and tissue donors. During the recovery process, the eye bank removed contact lenses from the delivery truck driver. The presence of the contact lenses was noted on the physical assessment under the ocular findings. The contact lenses were placed into a red top vacutainer with saline and logged in as decedent belongings. Subsequently, the surviving family members attempted to bring a wrongful death lawsuit against the furniture company. The family claimed that the driver was at fault because he was not wearing his glasses at the time of the accident. However, due to the eye bank documentation of the contact lenses found in the decedent's eyes upon recovery, this claim was accurately disputed.

Chain of Custody & Preservation of Evidence

In cases where recovery takes place prior to the death investigation, critical pieces of physical evidence may be obtained or moved from their original location due to the nature of the recovery process. Removal of clothing, belongings, therapeutic medical devices/portals of entry (e.g., central lines, endotracheal tubes [ET], intravenous lines [IV], intraosseous catheters, gunpowder residue on the hands, and/or dirt or debris surrounding an area of injury or wound prior to evaluation and documentation by the death investigator would be considered an alteration of evidence.

The establishment of defined practices and procedures to ensure the integrity of findings and chain of custody, such as decedent belongings and physical evidence, will likely strengthen the relationship between a medicolegal death investigation office and a recovery organization. Providing traceability during times when the donor is transported between facilities (e.g., hospitals, medicolegal death investigation offices, funeral homes) may locate items or evidence that may go missing when and if the chain of custody has been broken. Agreements between medicolegal death investigation offices, funeral homes, and recovery organizations should be established, at the discretion of each establishment.



Debris and medical artifact. Photo: Craig Nelson, MD.

The First Link: Establishing the Chain of Custody

The Organization of Scientific Area Committees for Forensic Science (OSAC) defines chain of custody as “The order in which a piece of evidence should be handled by persons investigating a case, specifically the unbroken trail of accountability that ensures the physical security of samples, data, and records in an investigation.” Chain of custody should be established upon receipt of the donor, with the date and time recorded. Documentation of observations, physical evidence, belongings, witnesses, specimens for testing, and the location of recovery are a few examples of things that may be considered when documenting chain of custody.

When establishing custody, it may be beneficial to document any present parties involved in or viewing the proceedings in any capacity. This includes recovery staff, transporters, mortuary service staff, hospital staff (e.g., security personnel), death investigators, or funeral home staff. Documentation of witnesses is beneficial when itemizing belongings or specimens, establishing chain of custody, collecting specimens, and releasing custody. The date and time custody is established should be clearly documented. A detailed inventory of belongings and specimens, and their condition at the time of receipt, may aid in cases in which liability is in question or the viability of evidence is under scrutiny.

Documentation should be descriptive, but not definitive. For example, “yellow metal ring with clear stone” should be documented instead of “gold diamond ring”. In the unfortunate event that belongings are lost or misplaced, documentation of decedent effects may be utilized in assessing property values.

Clothing or other items should not be physically altered, cut, or torn if possible. While it is imperative to be respectful, these belongings may also hold value in the investigative process. Damage to clothing or belongings may be used to match decedent injuries and provide more detail concerning how the injury took place. For injuries such as blunt force or sharp force trauma (e.g., gunshot wounds or injuries from a pedestrian vs. car), preservation of belongings (e.g., clothing, damaged items found in pockets) is critical to identifying the point of impact or the trajectory of a projectile. Essentially, patterns on clothing and personal items can be correlated to injury patterns on the decedent’s body.

Documentation of transportation may also be beneficial and relevant in efforts to maintain a positive working relationship between the recovery organization and medicolegal death investigation office to provide reference or arrival and departure times when the investigation, autopsy, or funeral services may be time sensitive or delayed due to the donation process.

Specimens collected for the death investigator are critical to the investigation and are considered physical evidence. Assuring the integrity and viability of this evidence is another critical element in maintaining the chain of custody. Just like patient belongings, transferred specimens should be documented when custody is obtained, at the time of collection, and when custody is relinquished.

The chain of custody of specimens is established when a representative of a recovery organization takes custody of a specimen or item. An example of this would be a recovery organization staff member picking up a pre-mortem blood sample from a hospital laboratory. Custody is then relinquished when custody is established by any other person(s.) For example, after the recovery is completed, that same recovery staff member gives a portion of the pre-mortem sample to the medicolegal death investigation office.

NAME OF DECEDENT		CASE NO.	
AGE	SEX	RACE	HEIGHT
PLACE OF DEATH		WEIGHT	
CAUSE OF DEATH		DATE OF DEATH	
PHYSICIAN			
FUNERAL DIRECTOR			
COMMENTS			

Now that chain of evidence has been described in detail, it becomes possible to identify breaches in custody, if they should happen. For example, following recovery, a secure seal or lock placed on a body bag may provide confidence that the integrity of evidence enclosed within the bag is maintained. A seal or lock may be single-use or reusable, (e.g., tag, wire lock, zip tie) which must be actively removed or damaged in order to open the body bag. Documenting when locks and seals are applied to evidence

helps to provide a timeline of when a breach in the chain of custody may have taken place and can clarify the probable location of lost evidence or decedent belongings. Furthermore, a tag, seal, or lock with an identification number that correlates to documentation within the donor record may provide an additional level of security and traceability.

◆◆◆ Case Study ◆◆◆

An 18-year-old male died secondary to blunt force trauma from a motor vehicle collision. During treatment in the field, medics cut the decedent's clothing and transected a silver metal necklace. Death was pronounced at the scene and all belongings, including the necklace, were enclosed in the body bag and transported to the local hospital morgue. The legal next-of-kin authorized donation and upon receipt of the decedent, the recovery technician noted a "broken silver-colored metal necklace and a cut black shirt" in the decedent's belongings. The family called, seemingly distraught, on the following day stating the recovery technician had destroyed the decedent's belongings. Documentation upon establishing custody permitted concise, positive follow-up to the grieving family members, as the damage occurred during life-saving efforts by paramedics.

Photography Methodologies

Recovery may cause alteration to the donor's physical appearance and/or belongings. The death investigator may request images to preserve evidence or the chain of custody. Images should be captured in a manner which enables the death investigator to clearly identify the anatomical or physical location of the photographed area. Photography should follow protocol established by the medicolegal death investigation office and the individual recovery organization in accordance with policies, procedures, and best practices.

Photographs should provide a clear reference with respect to specific points in time in the recovery process including 1) the receipt of the donor body, 2) prior to the removal of any medical/therapeutic artifacts and belongings/clothing, 3) after the removal of these items but before donor preparation, and 4) after the donor preparation, but before recovery. Images should be captured in areas with sufficient indirect lighting to permit clear visualization without overexposure, which will washout the area(s) being photographed.

Items (e.g., chest tubes, central lines) in an area of injury that do not prevent a proper donor preparation or recovery should remain in place and not disturbed whenever possible. For example, an endotracheal tube will not prevent the proper preparation or recovery of tissue from the lower extremities and may be relevant to the death investigation. This would be considered a medical/therapeutic artifact which should be left in place. The death investigator should be consulted if artifacts or belongings overlaying an area of injury may preclude a proper donor preparation or surgical recovery.

Editing

Images taken for the purpose of evaluation by a death investigator should not be altered or manipulated in any way. Editing may be permitted; however, depending on organizational practices or at the request of the death investigator.

Photo Scale & Donor Identifier

To ensure the preservation of evidence a measuring tool, such as a ruler or placard, and a donor identifier, such as the donor number, should be used when images are captured for screening/suitability and forensic or investigative purposes. Death investigators typically use a ABFO (American Board of Forensic Odontology) No. 2 Photomacrographic scale. This scale provides an accurate source of reference for visualization and the ability to scale measure the size of elements in the image in a scientific manner. The scale should be placed near the area being captured to provide an accurate point of reference and at 90 degrees of the area being photographed.



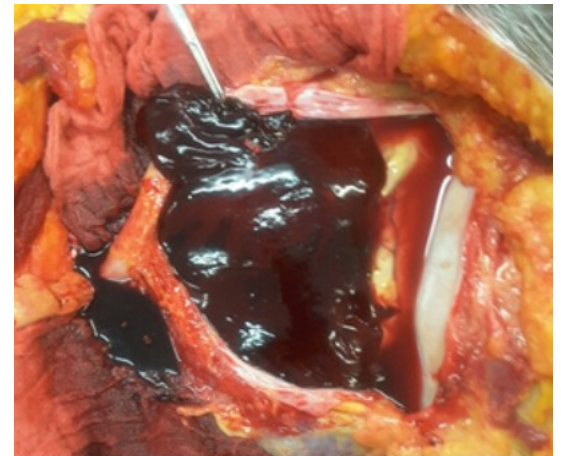
Photomacrographic scale used to measure an abrasion. Photo: Craig Nelson, MD.

Belongings & Chain of Custody

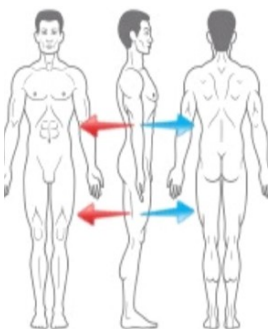
Photographs may be used to document the chain of custody of donor personal belongings, the condition of belongings, and specimens being moved or transported with the body. Images of belongings or specimens received with the body should be captured at receipt of the donor, prior to the alteration or removal of any items from the initial state of the body. Images of belongings or samples to be transported or moved with the body following recovery should be captured in the manner in which they are left by recovery staff. These images may be used to establish the organization's appropriate handling and transfer of the belongings and specimens.

Internal/Intraoperative Photography

Findings may be discovered during the recovery that require images of an area that are within a sterile field. Care must be taken to avoid contamination of the surgical field. If a close-range image is essential, photography equipment should be utilized in a manner which maintains the integrity of the sterile field and sterile recovery staff. If available, a sterile ruler or sterile scalpel handle with a ruler may be included in the field to provide scale. Actions and movements should be in accordance with the Association of periOperative Registered Nurses' Standards and follow the guidelines set forth in the AATB Aseptic Technique Guide.



Coagulated blood noted after the pericardial excision and prior to cardiectomy. Photo Craig Nelson, MD.



Full Body Images

Images for investigative purposes should not exclude any detail. This is contrary to most recovery photography protocol, which seeks to exclude identifying traits or characteristics of a decedent. Full body or overall images should include all aspects of the body, utilizing a technique which provides an accurate perspective and a range which provides sufficient detail for review and identification of all findings for investigative purposes. For example, capturing images of each plane

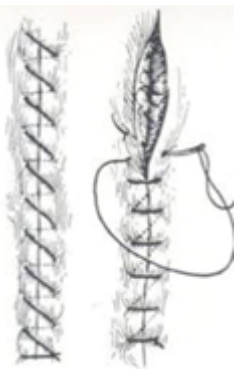


Full body photograph. Photos: Craig Nelson, MD.

of the body (anterior, posterior, left, and right) and in thirds (head to mid-torso, mid-torso to mid-thigh, and mid-thigh to foot.). The camera should always be held perpendicular to the subject being photographed. Some medicolegal death investigation offices require that images of the decedent show the entire body, from head to toe, in a single photograph. While this may be possible in an autopsy suite, as most are equipped with platforms for photographers to stand on above the patient, this may not be possible for a recovery staff in a standard operating room or other recovery environment. This should be discussed with the medicolegal death investigation office in advance.

Ocular Images

If required, ocular photographs should be taken prior to and after the recovery process. The intended purpose is to identify eye color, trauma (e.g., petechiae, subconjunctival hemorrhage), and the presence of contact lenses. Each of these can contribute to the determination of the cause of death. Care should be taken to follow the medicolegal death investigation office's processes for taking photographs. Please refer to the individual eye bank's protocol with the medicolegal death investigation office for exact imaging and file transmission preferences.

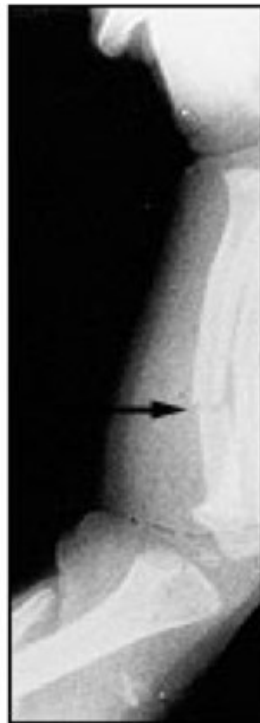


Reconstruction/Restoration

Organizational practices may require the capture of images for documentation of the donor prior to and/or following recovery. This may be done to provide a point of reference in circumstances in which the impact of the donation process or the integrity of restoration efforts is in question. If these efforts are in question, these images may help provide evidence that actions of the recovery organization did not cause any liability on their part. Images should include the entire surgical site prior to and following recovery.

Shared Organ Cases

In some circumstances images may be required on shared organ, tissue, and eye cases. This may include the capture of images of the patient on a hospital unit prior to organ recovery. In such situations, the patient may be unstable and altering the position of the body may have adverse effects, such as shifting medical devices critical to patient stability. Under such circumstances, it may be acceptable to complete partial image capture (e.g., anterior, left, right) to avoid excessive manipulation.



Radiography

In many cases the existence, extent, location, or severity of injuries and/or trauma may not be apparent during an external examination. The concern of the death investigator may be the oversight of internal injuries with limited or no external trauma. Furthermore, there may be concern of alteration, loss, or misdiagnoses of internal injuries such as soft tissue trauma or bone fractures due to the recovery process. Pre-recovery radiography may enable the death investigator to differentiate trauma or resuscitative efforts from artifacts of the recovery process. For example, during resuscitative efforts ribs may be fractured. If heart valves are recovered it may be difficult for the death investigator to clearly confirm if the origin of fractures

is trauma, resuscitative efforts, or transection of ribs during the heart recovery process.

Radiography – A technique of viewing structures of the body using electromagnetic radiation. Usually, radiographs are performed to view internal structures in situ but can also be used to analyze bones, tissues, and organs ex situ. X-rays, skeletal survey, CT, and MRI are commonly used radiography techniques.

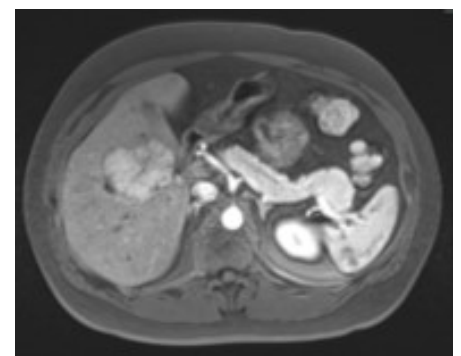
Skeletal Survey – A series of x-rays of all the bones in the body. A standard survey includes skull, spine, pelvis, ribs, and extremities. Skeletal surveys are used to assess entities such as bony trauma, non-accidental injuries in children, injury patterns, abnormal bone development, malnutrition, abnormal collections of air (crepitation tissue emphysema), and bone damage due to tumors. It is also used to detect foreign bodies such as bullets or medical devices.

Computed Tomography (CT) – An imaging scan that uses ionizing radiation to view both hard and soft tissues in slices as if the body were sliced like a loaf of bread. The word *tomo* means slice. CT scans are often used to view bony fractures, bone pathology, organ injury or disease, and fluid collections such as blood. Three dimensional CT can also be performed.

Magnetic Resonance Imaging (MRI) – Body imaging that uses magnetic fields, radio waves, and field gradients to generate images of the body. MRI is used to analyze soft tissues such as the brain, heart, liver, fat, cartilage, and tumors. It can also detect small hemorrhages. MRI has superior contrast resolution compared to CT.



CT example. Photo: Angela Levy, MD.



MRI example. Photo: Angela Levy, MD.

◆◆◆ Case Study ◆◆◆

An 18-year-old male was involved in a hit-and-run motor vehicle collision. 911 was called. Upon their arrival, he was in respiratory distress and had to be emergently intubated. He was taken to the nearest emergency department where he became unconscious. A large bruise was noted on his forehead, but no other traumatic external findings. The CT scan showed marked cerebral edema, subarachnoid hemorrhage, and a right subdural hematoma. His condition deteriorated and he was pronounced brain dead 12 hours later. His mother consented to organ, tissue, and eye donation, but the death investigator was hesitant to release for donation because the investigation pointed toward a homicide. The death investigator needed to be confident that no other trauma was missed or artifact created by recovery procedure. Therefore, a full body CT was ordered by the recovery organization. The study was negative for visceral and bony trauma. Due to these findings, the death investigator consented to organ, eye, and tissue recovery.

◆◆◆ Case Study ◆◆◆

A six-month-old infant was found dead in her crib. She was lying prone and partially covered by a quilt. The room was tidy and the temperature was comfortable. Her past medical history was positive for proper prenatal care, a spontaneous vaginal delivery at 39 weeks, and Apgar scores of 8 and 9 at one and five minutes, respectively. Well-baby check-ups were normal. She had two older siblings, aged three- and five-years-old, who were in good health. The parents consented to donation. The death investigator was not going to permit recovery because the cause of death was unknown and underlying trauma may have been present. The tissue recovery organization provided for both a skeletal survey and a full-body CT scan. The death investigator agreed to release to recovery if the skeletal survey and full-body CT scan were normal. They also required a cardiology report from the cardiac pathologist, provision of heart histology slides, and return of the residual remains of the heart after resection of the valves. The heart valves were successfully recovered and all requests fulfilled.

Toxicology

Toxicological testing, which oftentimes is performed in combination with an autopsy, looks for a variety of substances (analytes) present in the body. Analytes include alcohols, illicit drugs, prescription drugs (taken as prescribed or abused), common poisons, and household and industrial chemicals. Toxicological screening may identify only one drug or substance, or it may highlight the presence of multiple substances.

Toxicological screening can provide qualitative information, such as identifying the presence of a substance or its metabolites. They can also provide quantitative information, which allows for the measuring of the quantity of the analyte present. It is important to note that chemicals, or analytes, can come to rest inside of a patient in a variety of ways. Absorption of a chemical or substance can

occur through inhalation (e.g., lungs), ingestion (e.g., GI tract), injection (e.g., veins), or direct contact with the skin or mucous membranes (e.g., mouth, nose, dermal patches). This is why the DRAI specifically asks if the method of drug use is known, as the same substance can be snorted/smoked or injected.

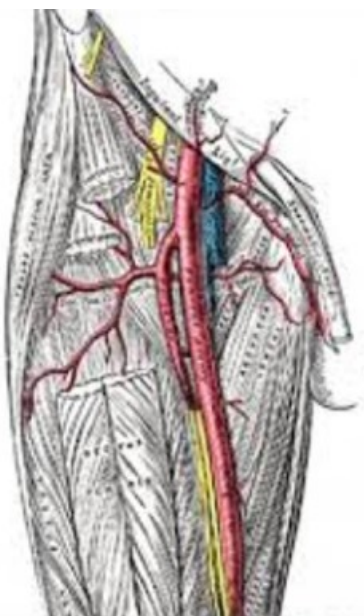
When toxicological screening is performed and how comprehensive or focused the tests are varies with jurisdiction and on a case-by-case basis depending on the circumstances of death.

One of the challenges with assessing toxicology against donor suitability criteria is the fact that toxicological results may take weeks to months to be finalized. This is partly due to the fact that in some jurisdictions, it may be a requirement that all toxicological screening is run by a government laboratory rather than a private toxicology firm. Some recovery organizations have sought creative approaches to this issue by offering medicolegal death investigation offices the option of running toxicological screening through a private laboratory at the recovery organization's cost. This is often seen as a win-win situation since toxicological results can be completed quickly and the death investigator does not have to pay for the tests.

It can be helpful, when evaluating toxicological results, to compare them to the documented physical assessment findings of the recovery organization staff and the physical assessment documented on the autopsy report. This is due to the fact that the review of relevant medical records should yield facts and information that align with one another in order to create a uniform clinical picture of the decedent. For example, if questionable marks on the decedent's lips appear like burn marks, receiving a toxicological result positive for methamphetamine is a confirmation that the patient was likely smoking the drug through a hot pipe during the time interval prior to death (days to weeks).

Specimens For Testing

The most common toxicological screens are performed on blood, but it is routine practice to analyze other specimens such as urine, gastric contents, liver, and vitreous humor. In some cases, toxicological evaluation of multiple body fluids are performed on the same patient.



Drawing blood from a peripheral blood vessel (e.g., the femoral vein or artery) may result in a more accurate toxicological assessment than blood drawn from the thorax (e.g., subclavian blood vessels, inferior vena cava, heart). This is due to the fact that different tissue types *take up*, or absorb, different levels of substances. Blood located in the chest, following cardiac cessation, can yield inaccurate toxicological results due to the redistribution of substances as they diffuse between the blood and surrounding organs (e.g., the heart and stomach). If a death investigator has requested that a recovery organization draw blood to conduct toxicological screening, extracting blood from the decedent's peripheral vessels is better than obtaining the blood from the heart or a more central vessel. The preferred sample site should be discussed with the partnering medicolegal professionals.

On the other hand, blood used for serological testing often has the best quality when drawn from the blood vessels of the thorax (e.g., subclavian vessels). This is due to the fact that blood in the legs may begin to form thromboemboli (clots) earlier than blood found in larger vessels near the heart. Blood that has begun to clot is difficult to draw and difficult to centrifuge when being prepared for antigen, antibody, and NAT (nucleic acid testing) to determine donor suitability. Sometimes toxicological results are obtained from bile, gastric contents, solid organ samples, and even hair. The toxicological results from an inpatient hospital chart more frequently involve identification assays performed on urine and are not always reflective of the same substances found at time of death in the blood.



Vacutainers Used For Testing

Blood can be placed in various types of blood vacutainers depending on the type of testing to be performed. While blood for serological testing by the recovery agency is most often placed into red, tiger, or purple (lavender) top vacutainers, blood for toxicology may be placed into a grey top vacutainer which contains a preservative (sodium fluoride) and an anticoagulant (potassium oxalate). Once a grey top tube is filled, it should be inverted several times in order to ensure that the additives in the vacutainer thoroughly mix with the blood

Vitreous Humor and Toxicological Screening

Vitreous humor is the transparent, colorless, gelatinous mass that fills the space between the lens of the eye and the retina lining the back of the eye. It is produced by cells in the non-pigmented portion of the ciliary body. Unlike the fluid in the frontal parts of the eye (aqueous humor), which is continuously replenished, the gel in the vitreous chamber is stagnant. The metabolic exchange and equilibration between systemic circulation and vitreous is so slow that vitreous is sometimes the preferred choice as an “alternate bio-specimen” for post-mortem analysis. Additionally, vitreous is generally less susceptible to contamination due to the closed structure of the eye and is better preserved than blood after death.

Procurement of Vitreous

For eye donors it is preferred that the vitreous fluid be drawn post-corneal recovery. For many eye banks, vitreous draw prior to recovery precludes the tissue’s viability for transplant. Technicians are trained on proper vitreous sample collection, labeling, and chain of custody according to the medicolegal death investigation office’s standards. Vitreous can be drawn after corneal recovery using a needle and syringe inserted into the globe of the eye. The insertion is best at the lateral canthus, introducing the end of the needle to the center of the globe. The vitreous should be withdrawn slowly. A vacuum collection system should not be used thus rendering the specimen inadequate due to retinal contamination. The following things should be considered when drawing vitreous:

- The gauge of the vitreous needle. The larger the gauge, the increased likelihood for the introduction of contaminants.
- The size of the syringe. The larger the syringe, the greater increase in the pressure of the draw and likelihood for the introduction of contaminants.

- Consider including supplies to draw a vitreous sample from each eye. If a contaminated sample is recovered from the first eye, there is an opportunity to draw a clean sample from the second eye.
- Determine during penlight exam if vitreous has been drawn prior to ocular recovery.
- If vitreous has been drawn prior to cornea recovery, ensure that the cornea has not been compromised.
- The eye bank's SOP should be followed if vitreous has been drawn prior to ocular recovery. Depending on the how the vitreous was drawn (e.g., aseptically or not, through the clear cornea) and the resulting shape of the cornea, some eye banks will continue with the recovery. Others will choose not to recover the tissue regardless of how vitreous was drawn

Approximately 2 mL of fluid can be aspirated from each eye. The vitreous should be placed in a sterile tube. Unless otherwise specified by the death investigator, the specimen should be collected in a red top with no additives. The specimen should be clear and colorless. If small flecks of black-brown retina appear in the sample, the sample may be deemed inadequate for evaluation.

Ensure that the proper protocol for handling and transporting samples is established and understood by all involved agencies. Once vitreous samples have been obtained it is important that they reach the designated destination for analysis. If the recovery of the sample takes place at the medicolegal death investigator's office, there may be a designated location for storing the sample. Other circumstances may dictate that the sample be left with the decedent for transport to the medicolegal death investigation office. Whatever protocol is implemented, it must be adhered to by all parties in order to facilitate the safe transport and chain of custody for the specimen.



Clean vitreous sample.

Performable Post-Mortem Vitreous Analyses

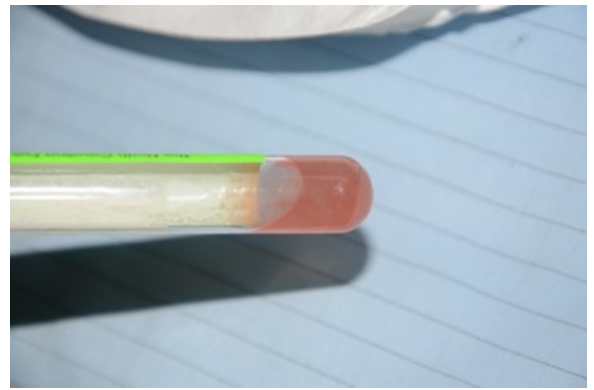
Depending on the environment, vitreous fluid can be procured up to approximately 4 days after death. Vitreous is best stored in a refrigerated environment, but can be frozen for the purpose of archiving. Testing of vitreous demonstrates chemical changes immediately or shortly after death and can be used to aid in determining the cause and or approximate time of death. Analyses that can be performed on vitreous fluid include chemistry for the following:

- Electrolytes: potassium, sodium, chloride, magnesium, calcium
- Physiological substances: glucose, ketones, urea, insulin, catecholamines, C-peptide
- Toxicology: drugs, ethanol
- Viral antibodies
- Acids
- Some trace metals

Contaminated Vitreous Samples

Care should be taken when vitreous samples are collected so as not to contaminate the sample with other substances. A contaminated vitreous specimen carries the risk of preventing proper identification of a potential cause and manner of death. Blood, povidone-iodine, uveal pigment, and bits of retinal material can all be considered contaminants to the sample that will affect the outcome of the testing or deem the sample unacceptable for analysis.

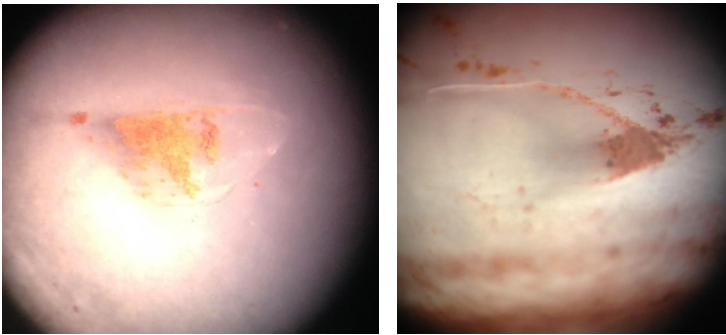
The ramifications for submitting a contaminated vitreous sample is, in part, a sample with particulates can physically clog the filtering mechanism. Secondly, if blood, povidone-iodine, ETOH, or some other non-vitreous component is in the tested sample, it can skew the results.



Contaminated vitreous sample.

Below demonstrates what a vitreous draw looks if the needle penetrates the cornea. Note the beveled shape, indicative of the shape of an aspiration needle. The deposition of red blood cells at the exit suggests the needle had been previously used on a blood draw. Following the rationale that different tissues within the body absorb analytes at different rates, a death investigator may compare the vitreous toxicological results to the blood toxicological results in order to correlate the post-mortem findings with the given history.

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Slit lamp image of a cornea (endothelial side). Photos: Samantha Wetzler, MD.

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◆◆◆ Case Study ◆◆◆

An obese male was discovered by his roommate laying supine on the floor between the sofa and living room table. He was last seen alive 3 hours ago. Upon discovery, his skin was cool to the touch and there was no pulse. He was cyanotic (blue skin) and had bubbly foam emanating from his mouth and nose. The death investigator was contacted and upon investigation, he was pronounced at the scene. On the coffee table was a closed metal box, a spilled bottle of soda, and several burn marks. The decedent was a smoker. On the floor was a leather belt laying next to a pile of dirty laundry. A small gauge insulin needle was found on the table, but this was associated with his 10-year history of insulin-dependent diabetes mellitus (IDDM). Although distraught, his family authorized donation and there was nothing in his medical history that contraindicated donation. His musculoskeletal tissue, skin, and eyes was recovered for donation. Six weeks later, the autopsy report with toxicological profile was released and the main abnormality was that the donor was positive for heroin and 6MAM-morphine. The manner of death was filed as *accident*. The cause of death was an acute overdose of heroin.

(continued)

You may have already noticed certain details in the scene investigation that were relevant but overlooked by (or not communicated to) the recovery organization before donation. Although the patient was diabetic, this did not fully explain the presence of the needle on the table. It is known that heroin abusers often keep their *kit*, or drug paraphernalia, in containers that they store and bring out when they are ready to take another dose. Insulin-sized needles are often used for intravenous drug abuse since they are small and are less likely to cause track marks or show needle marks after injection. The presence of the belt on the floor could have indicated that the patient did not keep a tidy home, or it may have been used to put pressure on his upper arm during the injection of drugs (it can be noted that a trained death investigator would inspect the belt for teeth marks, since this is how the belt is held tight during injection). The presence of a foam cone or foam cap over the mouth and nose can indicate an acute overdose of opiates due to acute pulmonary edema. Unfortunately, unless this is observed and documented immediately, this foam is transient and can be wiped away or vanish later when the decedent is placed in the body bag and moved to another location. A foam cone is rarely, if ever, noticed during a recovery organization's physical assessment at the time of recovery.

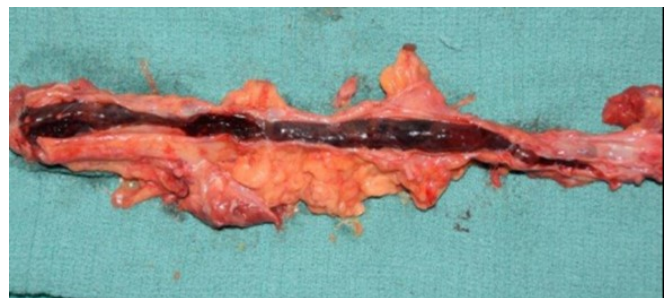


Foam cap present in some cases including drug overdose. Photo: Kim A. Collins, MD.

Clots: Thrombus, Thromboembolus, and Post-Mortem Clot

There are many circumstances which may lead to sudden unexpected death which do not have any warning or contributory history. One such instance is pulmonary thromboembolism. Identifying clots during tissue recovery may be helpful in the death investigation process and establishing these practices in collaboration with the medicolegal death investigator may preserve the opportunity for donation on sudden unexpected deaths.

A thrombus or pre-mortem clot that forms within an artery, vein, or heart chamber, is composed of blood elements (blood cells, platelets, and fibrin). A thrombus forms due to vessel injury, heart chamber injury, or blood stasis. There are several risk factors for thrombus formation including obesity, pregnancy, smoking, injury, recent surgery, and sedentary lifestyle. The blood components attach to the vessel wall as thin layers creating a striped appearance both grossly and microscopically (lines of Zahn). The layers are dark red (blood cells) and gray (fibrin and platelets). Usually these form in



Deep vein thrombosis (femoral) found at autopsy. Photo: Daniel Schultz, MD.

the deep leg veins or pelvic veins; however, they can form in other areas of vessel injury. Although such findings would not be the defining cause of death, finding a thrombus in the deep veins of the lower extremities may point to additional thrombi or thromboemboli.

Blood Clots Discovered During Heart for Valve Recovery

The heart valve recovery is invasive and can potentially lead to the disruption, loss, or misdiagnosis of critical findings. The transection of the pulmonary veins and arteries during for valve recovery may preclude the death investigator from appropriately diagnosing these findings if effective practices are not in place.

Pulmonary thromboembolus, also called a pulmonary embolus (PE) — A thromboembolus within the pulmonary artery or the more distal vessels of the lungs which originally formed in a distant site (as a thrombus) and was dislodged to become an embolus, or thromboembolus, and traveled to the lung. The pulmonary thromboembolus is often the diameter of the deep leg vein, such as the popliteal vein, and is coiled upon itself, obstructing the left, right, or both pulmonary arteries.



Pulmonary emboli. Photo: Kim A. Collins.

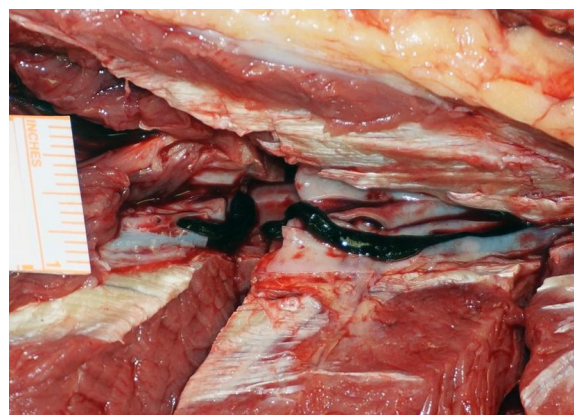
Thromboembolus — A thrombus that has become dislodged and travels to a different location in the body. The word *embolus* means *to throw*. A thromboembolus is often coiled upon itself and has the diameter of the vessel in which it originally formed. The cut surface can have a striped appearance due to the layering of the blood elements when it originally formed. It is slightly firm and friable and is usually in a right heart chamber, pulmonary artery, and/or vessel(s) of the lung. Much like thrombi found in the legs, these findings of thromboemboli are essential to the death investigation. Thromboemboli within the heart, lungs, or associated vasculature will likely either be or directly contribute to the cause of death.

Blood Clots Discovered During Lower Musculoskeletal or Vascular Recovery

Deep leg veins — The legs have superficial veins (near the body surface) and deep veins (deep within the leg). They are the iliac, femoral, popliteal, and tibial veins.

Thrombus — As described above, a thrombus may be discovered in a deep leg vein. A thrombus may be attached to the vein wall or unattached within the vein.

Post-mortem blood clot — A clot that forms within a blood vessel after death due to the settling and separation of blood components. The separation of the blood components leaves a two layer, dark red and yellow-tan, appearance but not the multiple striped lines of Zahn as in a thrombus. Many describe it as looking like chicken fat. The consistency is soft and slightly rubbery. This type of clot assumes the shape and diameter of the blood vessel in which it is found post-mortem.



In situ deep vein thrombosis lower extremity. Photo: Joseph Prahlow, MD.

Documentation and Preservation of Thrombi, Thromboemboli, and Post-Mortem Blood Clots

Documentation of the location and size of the clots may prove beneficial to the death investigator. Practices may be established by the recovery organization and the death investigator to document, photograph and collect such findings for further evaluation in the medicolegal death investigation.

The death investigator should be consulted if any such findings are unexpectedly discovered during recovery. Documentation, photography, and collection practices of such clots should be established by each recovery organization and practices may be specific to individual death investigators depending on the circumstance and jurisdictions.

1. Photograph the clot in situ.
2. Gently place the specimen into a container and send with the decedent to the death investigator for evaluation.
3. Document on paperwork the location, size, appearance, and disposition of the clot specimen.

◆◆◆ Case Study ◆◆◆

A 65-year-old accountant was working overtime during tax season. She drove an hour to her condominium late one evening. Upon walking to the elevator, she became short of breath and collapsed. The doorman called 911. She was pronounced dead on the scene. Her past medical history included diabetes mellitus and obesity. The death investigator felt the cause of death was heart-related and allowed pre-autopsy tissue recovery. During recovery of the heart, the technician saw the finding depicted in the image below. The technician immediately halted the recovery procedure and photographed the pulmonary thromboembolus. She then called the death investigator to relay the finding. The death investigator was pleased with her detection and quick notification. The death investigator requested that the pulmonary thromboembolus be placed in a container of formalin if it became dislodged during recovery. This way the thromboembolus could be processed in the histology laboratory for microscopic examination if needed. The cause of death was certified as pulmonary thromboembolus, a finding that may have gone unnoticed if not for the technician's careful attention.

Document and Medical Record Sharing with Death Investigators

Information obtained during or as a result of the donation process may be of value to the medicolegal death investigation. Medical records may be considered evidence and should be provided to the death investigator for the sake of a comprehensive medicolegal death investigation. Some state statutes actually require the sharing and documentation of all physical findings and medical records. These statutes, if they exist, should be evaluated by each organization and jurisdiction. Agreements and practices for distribution should be developed by the individual recovery organization and the death investigator. As the death investigation and surrounding information is time-sensitive, practices should be developed which promote an expeditious release of information.

What Information May Be Beneficial to the Death Investigator?

Examples of relevant beneficial information may include, hospital culture results, final diagnostic radiographic dictations, serology/NAT testing results, funeral home information, tissue processing culture results, the Donor Risk Assessment Interview (DRAI), the donor chart and physical assessment forms, emergency services reports, and progress notes.

The physical assessment performed on the donor prior to recovery and autopsy may provide much needed information to the death investigation. The physical assessment can also aid in confirming the identification of the donor. Estimated or reported information about the donor's weight, height, sex, race, the hospital ID band with a medical record number (MRN), and reported tattoos or piercings, can be cross-referenced with the DRAI and other medical records.

Recovery notes documented before, during, and after the recovery may contain detailed information of physical findings and chain of custody of collected evidence. These may include blood samples, vitreous fluid, medication patches, IV medication, clothing, bagged hands for gunshot residue testing, subdermal or intramuscular bruising noted during recovery, and noted internal trauma within recovery sites (e.g., extremities, chest, abdomen).

Cardiac pathology reports and histology slides are essential for a death investigation. These reports can provide information that may be helpful in determining manner or cause of death, such as valvular heart disease, cardiomyopathies, endocarditis, ischemic heart diseases, ischemic heart diseases, or benign or malignant tumors. Heart valve processing reports and processing specification documentation may provide the death investigator with information regarding findings such as stenosis, calcification, rheumatic heart disease, and congenital abnormalities.

Ocular images and documentation of ocular abnormalities can be useful in gathering information surrounding the death of an individual. Certain findings, such as conjunctival hemorrhage or petechiae, can indicate trauma that may not be apparent during the body inspection.

◆◆◆ Case Study ◆◆◆

A 35-year-old woman was found dead as a result of head and neck injuries. The death investigator suspected that the injuries and cause of death were due to a fall taken by the decedent. The death investigator released for eye donation prior to autopsy. During the recovery, the technician noted petechiae to both eyes. The technician took images, as per standard protocol, performed the recovery, and notified the death investigator of the findings. As the death investigator collected information surrounding the case, there was suspicion of domestic abuse. The petechiae that was noted by the technician led the death investigator to look at the injuries more closely. Because of this information, it was discovered that the fall was secondary to strangulation. NOTE: Based on the agreed upon protocol with the medicolegal death investigation office, photographic evidence may be sufficient, or it may require an additional phone call prior to recovery.



Donor Risk Assessment Interview (DRAI)

A donor risk assessment interview, or DRAI, is a documented dialogue conducted in person or by telephone with an individual or individuals knowledgeable of the donor's relevant medical history and social behavior. The relevant social history is elicited by asking questions regarding certain activities or behaviors that are considered to place such an individual at increased risk for a relevant communicable agent or disease.

Thorough risk assessment questions are answered by the individual completing the DRAI to screen for eligibility. These answers are recorded as part of the donor chart and offer a detailed description of the donor's history. Information obtained from the authorizing person on the DRAI by the recovery organization may be critical to the investigation and may include, but is not limited to: alcohol use, prescription drug use, recreational drug use, over-the-counter drug use, mental illness, incarceration, chronic and acute medical history, surgical history, primary care physicians and specialists visited by the decedent, and travel history. This interview may provide critical information and details surrounding the donor's history that connect or contribute to the cause and manner of death. For example, the sudden, unexpected death of a middle-aged individual while walking on the street may be simply and easily explained if a chronic history of untreated cardiac disease is revealed in the DRAI. This information may even rule the case a natural death, therefore transitioning the death certification to the primary care physician or clinician instead of the death investigator.

Infectious Disease Screening Results: Reasonable Disclosure of Information

The Department of Health and Human Services 45 CFR 164.512(b)(1)(iv) permits the disclosure and sharing of protected health information by covered parties when there is the potential for contraction and/or spreading of communicable diseases. All relevant medical records are discoverable as physical evidence and relevant to the medicolegal death investigation by death investigator.

Serological, nucleic acid testing (NAT) (AATB Standards for Tissue Banking D4.230), or infectious disease screening results (e.g., Ebola, Zika, Chagas) may be provided in accordance with the established practices and procedures as agreed upon by the individual recovery organization and the death investigator.

Conclusion

The American Association of Tissue Banks and the Eye Bank Association of America recognize the essential role that death investigators play in the donation process and acknowledge the concerns of medicolegal death investigation professionals with respect to potential loss of evidence during the donation process. It is recommended that individual recovery organizations establish standard procedures and practices in collaboration with death investigators in their service areas. We also recognize that jurisdictions, roles, and expectations will differ greatly between regions, states, and counties.

It is imperative to establish a positive relationship with death investigators allowing the open exchange of information. Using all available information to assist and contribute to determining the cause and manner of death.

The practices illustrated throughout this guide may assist in the preservation of evidence and in some instances enable donation to take place in cases which would have not otherwise been possible. These practices are not requirements or standards but are intended to serve as a point of reference, education, and summary of possible solutions in order to further educate the donation community about the medicolegal death investigation process.

◆◆ OSAC Glossary ◆◆

All definitions in this section and in **green** in the text can be found at <https://www.nist.gov/topics/organization-scientific-area-committees-forensic-science/osac-lexicon>

Accidental Death — An unexpected or unforeseen death due to injury.

Algor Mortis — The change of body temperature to ambient temperature. A body will not cool if it is located in an environment greater than 98.6 degrees F.

Analyte — A chemical substance to be identified and/or measured.

Analysis — Analytical activity carried out during the forensic process to determine characteristics, specifications, or relevance of potential exhibits or conditions. The measurement of analyte and/or evaluation of data.

Analyze — To examine, measure, or test the properties of a material for evaluation purposes.

Antemortem — Before death.

Artifact — A by-product, artificial feature, or change resulting from human activity or a technical process.

Autopsy — A diagnostic medical procedure consisting of postmortem external and internal examination of a human body; conducted by a pathologist. It may be supplemented by ancillary tests and examination such as toxicology, histologic evaluation, and specialty consultation.

Best Practice — A system of processes, checks and testing that will deliver an outcome that has fewer problems and fewer unforeseen complications, and that combines the attributes of the most efficient and most effective ways of accomplishing a task based on proven and provable methods.

Blood — Blood is a body fluid in humans and other animals that delivers necessary substances such as nutrients and oxygen to the cells and transports metabolic waste products away from those same cells.

Blood Clot — A gelatinous mass formed by a complex mechanism involving red blood cells, fibrinogen, platelets, and other clotting factors.

Blunt Force Trauma — An alteration to the skeleton produced by low-velocity impact from a blunt object (e.g., being struck by an object or concussive wave) or the low-velocity impact of a body with a blunt surface (e.g., motor vehicle accident or fall).

Capture — To record data, such as an image, video sequence, audio stream, or biometric sample to digital storage, often by means of a sensor.

Cause of Death (COD) — Medical opinion of the disease or injury that resulted in a person's death.

Chain of Custody — The process used to maintain and document the chronological history of an item of evidence. Documents the individual who collected the evidence and each person or agency that subsequently takes custody of it. This chain of custody verifies evidence integrity meaning that the evidence being analyzed is the same evidence that was found at the scene and that there was no opportunity for the evidence to be tampered or compromised. A chain of custody should be maintained for an item until it is released, disposed of or destroyed.

Confirmatory Test — A test that is specific for a biological material or substance of interest and that is used for the conclusive identification of a biological fluid; this usually refers to a serological or microscopic test for detection of a particular biological fluid (e.g., blood or semen).

Contamination — Unintended presence, or introduction, of particles, chemicals, and other substances.

Continuing Education — An educational activity (such as a class, lecture series, conference, seminar, or short course) that is offered by a recognized organization or individual that updates participants in their relevant area of knowledge.

Coroner — Generally an elected (sometimes appointed) official whose duty is to oversee medicolegal death investigations, usually for a single county, and certify cause and manner of death. An officer of a county or municipality whose chief function is to investigate by inquest as before a jury any death not clearly resulting from natural causes (see medical examiner).

Database — An authoritative repository of information used for storage, search and analysis.

Death Certificate — A formal vital statistics document certifying the identification, cause and manner of death of a particular individual.

Death Scene — The site where a person has died; the term may also refer to the location where the decedent was found.

Decedent — A deceased individual.

Documentation — Written notes, audio/videotapes, printed forms, sketches and/or photographs that form a detailed record of the scene, evidence recovered, and actions taken during the search of the crime scene.

Evidence — Objects or information which should be identified and collected for appropriate documentation and analysis to support conclusions in forensic scene investigations.

Forensic — The use or application of scientific knowledge to a point of law, especially as it applies to the investigation of crime.

Forensic Pathologist — A physician who is certified in forensic pathology by the American Board of Pathology (ABP) or who, prior to 2006, has completed a training program in forensic pathology that is accredited by the Accreditation Council on Graduate Medical Education or its international equivalent or has been officially “qualified for examination” in forensic pathology by the ABP. May be employed as a Medical Examiner or as a consultant to a coroner of Justice of the Peace.

Gross Examination — Assessment of materials with the naked eye.

Gunshot Residue — Sometimes defined as the total residues resulting from the discharge of a firearm. Constituted typically of nitrites and lead, as well as unburned and partially burned gunpowder particles, carbonaceous material plus metallic residues from projectiles, fouling, and any lubricant associated with the bullets. These are usually observed with the naked eye, or an optical microscope, and detected or visualized by the Griess test and sodium rhodizonate.

Homicide — Death as a result of a volitional act committed by another person (injury, poisoning, etc).

Image — Imitation or representation of a person or thing, drawn, painted, photographed, and so forth.

In situ — In the original place or position.

Ingestion — Taking of substances into the body by mouth.

Jurisdiction — A geographic area in which a medical examiner or coroner’s authority applies. Legal authority to make legal decisions and judgments regarding a death, including performance of autopsy, as well as investigation and certification of cause and manner of death.

Manner of Death (MOD) — Classification system based on the circumstances under which death occurred; includes accident, homicide, natural, suicide, and undetermined. Death occurs in one of four manners: natural, if caused solely by disease; accidental, if it occurs without apparent intent; suicide, if caused by the deceased; homicide, if someone other than the deceased caused it.

Measurement Scale — An object showing standard units of length (e.g., ruler) used in documentation of an item of evidence.

Medical Examiner — An appointed medically qualified officer whose duty is to investigate deaths and bodily injuries that occur under unusual or suspicious circumstances, to perform post-mortem examinations.

Medicolegal — Pertaining to medicine and law.

Medicolegal Death Investigation — A formal inquiry into the circumstances surrounding the death of a human being; investigative information is considered with autopsy findings and adjunctive studies (if performed) to determine the cause and manner of death.

Medicolegal Death Investigation System — Medicolegal death investigation office(s) within a state or district (usually a medical examiner or coroner office) that is a jurisdictional unit with a single chief medicolegal death investigation officer.

Medicolegal Death Investigator — The medicolegal investigation includes the collection of data, photographs, evidence, witness interviews, external examination of the body at the scene, and other forensic information and analysis that will contribute to the determination of cause and manner of death, reconstruction of the accident or crime scene, and support the provision of survivability factors. The medicolegal investigation falls within the exclusive purview of the medicolegal authority operating at the scene of an incident. A formal inquiry into the circumstances surrounding the death of a human being; the conclusions of the investigation are taken in concert with the autopsy findings and adjunctive studies in determining the cause and manner of death.

Natural Death — Death due solely to natural disease.

Next of Kin — Legally determined hierarchy of interested parties who have authority over the body.

Notes — The written documentation of procedures, standards, control and instruments used, observations made, results of tests performed, charts, graphs, photographs, sketches and other documents generated that are used to support the analyst's conclusions.

Nucleic Acid — An important class of macromolecules, which are polymers of nucleotides, found in all cells and viruses. DNA and RNA are the major types. The functions of nucleic acids have to do with the storage and expression of genetic information. Deoxyribonucleic acid (DNA) encodes the information the cell needs to make RNA and proteins. A related type of nucleic acid, called ribonucleic acid (RNA), comes in different molecular forms that participate in protein synthesis.

Pathology — The study and diagnosis of disease.

Personal Effects — This refers to property, including clothing, jewelry, wallets or other items found on a decedent's body. Personal effects are categorized as associated or non-associated directly with the remain, with regard to proximity to the decedent (i.e. a wallet in a pocket of a decedent's pants would be considered associated PE; however, the same wallet found in the body bag of a visually unidentifiable decedent would be considered unassociated).

Personal Protective Equipment (PPE) — Equipment such as safety glasses, goggles, face shields, gloves, chemical-resistant suits, and so on that are worn or used to protect individuals from the dangerous effects of materials that they are handling or exposed to.

Physical Evidence — Anything that may be found or associated with criminal activity at a crime scene.

Policy — A guiding principle, operating practice, or plan of action governing decisions made on behalf of an organization.

Post-mortem — After death.

Postmortem Examination — An examination of a dead body to determine cause of death.

Pre-mortem — Before death.

Protocol — A set of instructions that explain the correct conduct and procedures to be followed in a specified situation.

Radiography — Technique for generating and recording an x-ray pattern for the purpose of providing the user with a static image(s) after termination of the exposure.

Residue — Remnants of a target substance that can be recovered and quantified.

Rigor Mortis — Stiffening of the body after death; a time dependent change that helps determine time of death.

Sample — A group of items, test results or portions of material, taken from a large collection of items, test results or portions of material, that serves to provide information that may be used as a basis for making a decision concerning the larger collection.

Scene — Any environment in which human remains and associated materials may be recovered.

Serology — The detection, characterization, identification, and/or typing of body tissues and fluids, either in native form or as stains or residues left at a crime scene using physical methods (normal and enhanced lighting), biochemical assays and/or microscopy; This definition applies to current crime biology laboratory practices which may be followed by DNA testing.

Sharp Force Trauma — Skeletal trauma produced by a tool that is edge pointed or beveled.

Specimen — Samples of tissues (including blood or hair), secretions (breast milk, saliva, or sweat), excretion products (bile, exhaled air, or urine), and other material such as stomach contents or vomit derived from a patient.

Standard — An established or widely recognized model of authority or excellence as a reference point against which other things can be evaluated or the ideal in terms of which something can be judged.

Standard Operating Procedure — Written procedure that describes how to perform certain organization activities.

Suicide — Death resulting from intentional self-inflicted act.

Trauma — A physical injury or wound caused by an external force of violence, which may cause death or permanent disability. Trauma is also used to describe severe emotional or psychological shock or distress.

Toxicology — A scientific discipline concerned with the analysis of biological materials for the presence of potentially harmful substances.

◆◆ Donation Glossary ◆◆

Authorizing Person – Upon the death of the donor, the person, other than the donor, authorized by law to make an anatomical gift. 14th Edition AATB Standards for Tissue.

Donor Risk Assessment Interview (DRAI) – A documented dialogue in person or by telephone with an individual or individuals who would be knowledgeable of the donor's relevant medical history and social behavior. For example this may be: the donor, if living; the next of kin; the nearest available relative; a member of the donor's household; other individual with an affinity relationship (e.g., caretaker, friend, significant life partner); and/or the primary treating physician. Alternatively, a living donor may complete a written questionnaire. The relevant social history is elicited by questions regarding certain activities or behaviors that are considered to place such an individual at increased risk for a relevant communicable disease agent or disease (RCDAD). 14th Edition AATB Standards for Tissue Banking.

Family History – An essential part of a patient's medical history in which he or she is asked about the health of members of the immediate family in a series of specific questions to discover any disorders to which the patient may be particularly vulnerable, such as "Has anyone in your family had tuberculosis? Diabetes mellitus? Breast cancer?" Hereditary and familial diseases are especially noted. The age and health of each person, age at death, and causes of death are charted. Often a genogram is developed for pictorial documentation. The family health history is obtained from the patient or family in the initial interview and becomes a part of the permanent record. Other questions, such as those concerning the age, sex, relationships of others in the household, and marital history of the patient, may also be asked if the information has not already been secured. Mosby's Medical Dictionary, 9th edition. © 2009, Elsevier.

Psychiatric History – A person's mental profile, which includes information about chief complaint, present illness, psychological adjustments made before onset of disease, individual and family Hx of psychiatric or mental disorders, and an early developmental Hx. McGraw-Hill Concise Dictionary of Modern Medicine. © 2002, The McGraw-Hill Companies, Inc.

Physical Assessment (PA) – A recent ante-mortem or postmortem documented evaluation of a deceased donor's body that can identify evidence of: high-risk behavior and signs of HIV infection or hepatitis infection; other viral or bacterial infections; or, trauma to the potential recovery sites. 14th Edition AATB Standards for Tissue Banking.

Relevant Medical Records – A collection of documents including a current donor risk assessment interview, a physical assessment/physical examination, laboratory test results (in addition to results of testing for required relevant communicable disease agents), relevant donor records, existing coroner and autopsy reports, a certified copy or verified copy of the death certificate (when applicable), as well as information obtained from any source or records which may pertain to donor eligibility regarding high risk behaviors, and clinical signs and symptoms for any relevant communicable disease agent or disease (RCDAD), and/or treatments related to medical conditions suggestive of such risk. 14th Edition AATB Standards for Tissue Banking.

Relevant Recovery Documentation – Records generated before, during, and/or after the Recovery of donated tissues which includes a Physical Assessment, a list of tissues recovered, as well as findings of internal trauma/injuries and/or surgical sites. 14th Edition AATB Standards for Tissue Banking.