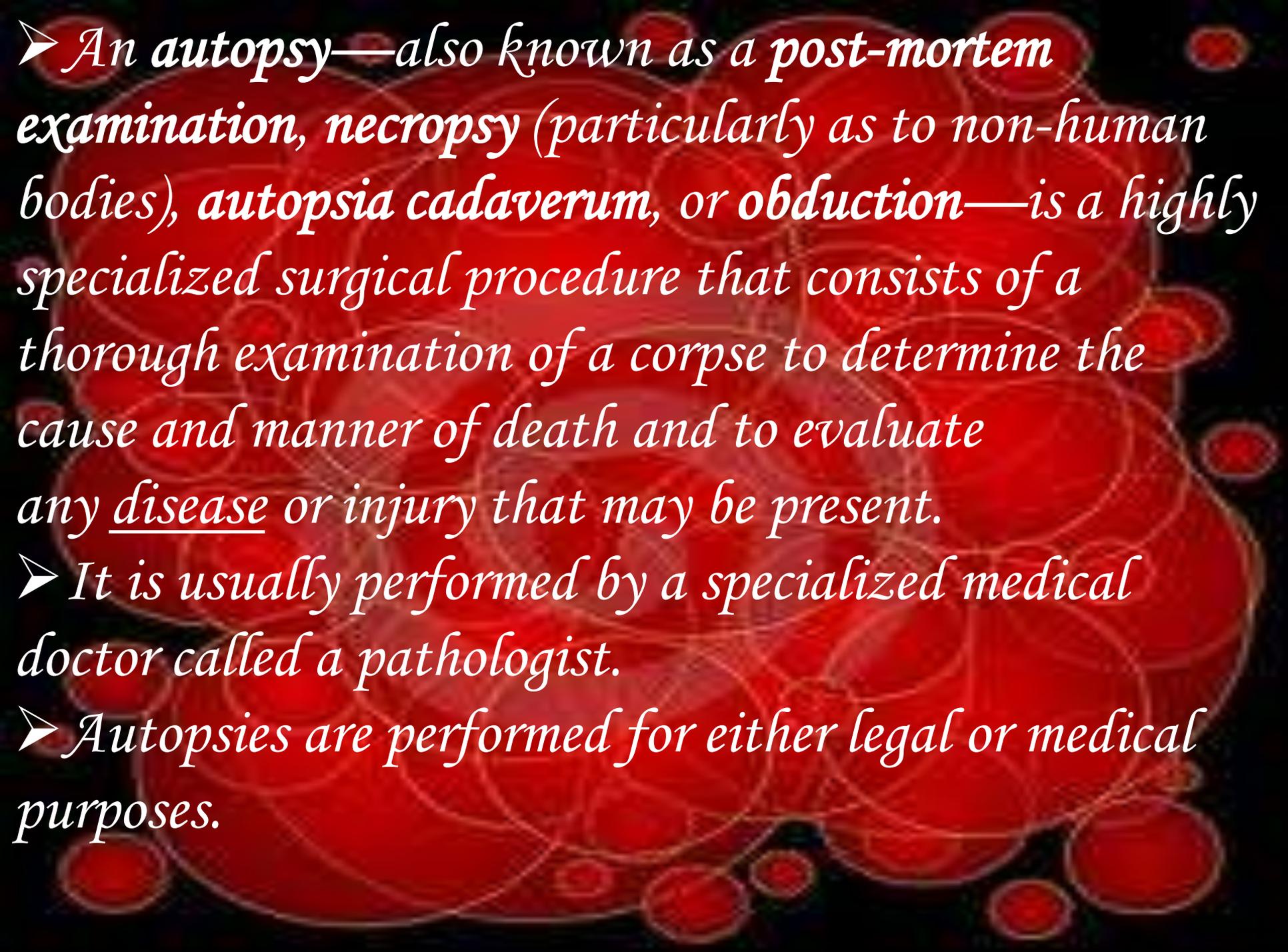


Postmortem Toxicology

CUTM1648: Concepts of Toxicology

By: Dr. R.C Jhamtani

Toxicology (from the Greek words *ΤΟΞΙΚΟΣ* - *toxicos* "poisonous" and *logos* means study & knowledge) is a branch of biology, chemistry, and medicine concerned with the study of the adverse effects of chemicals on living organisms. It is the study of symptoms, mechanisms, treatments and detection of poisoning, especially the poisoning of people.

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- *An autopsy—also known as a post-mortem examination, necropsy (particularly as to non-human bodies), autopsia cadaverum, or obduction—is a highly specialized surgical procedure that consists of a thorough examination of a corpse to determine the cause and manner of death and to evaluate any disease or injury that may be present.*
 - *It is usually performed by a specialized medical doctor called a pathologist.*
 - *Autopsies are performed for either legal or medical purposes.*

- *For example, a forensic autopsy is carried out when the cause of death may be a criminal matter, while a clinical or academic autopsy is performed to find the medical cause of death and is used in cases of unknown or uncertain death, or for research purposes.*
- *Autopsies can be further classified into cases where external examination suffices, and those where the body is dissected and internal examination is conducted.*
- *Permission from next of kin may be required for internal autopsy in some cases. Once an internal autopsy is complete the body is reconstituted by sewing it back together.*

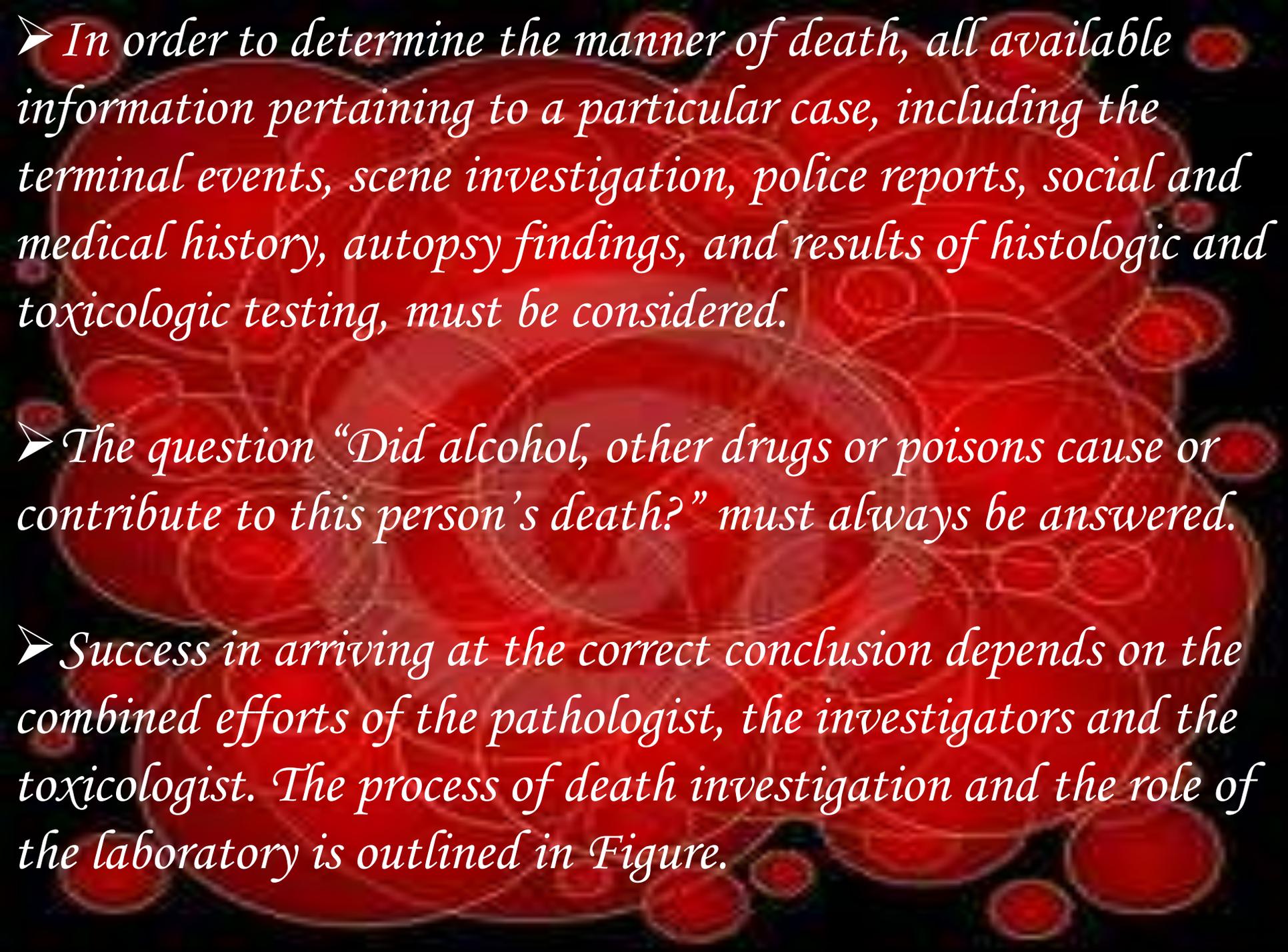


- *The Medical Examiner's Office investigates sudden, violent, unnatural or unexpected deaths, and the medical examiner, coroner or pathologist, is responsible for determining the cause and manner of death.*
- *The cause of death is the injury, intoxication or disease that initiates a process leading to death, and if that initial event had not occurred, the individual would not have died.*
- *Death may follow years after the causal event. The manner of death is the circumstances in which the cause of death occurred.*

➤ *Five classifications are used to categorize the manner of death:*

*Homicide,
Suicide,
Accident,
Natural
Undetermined*

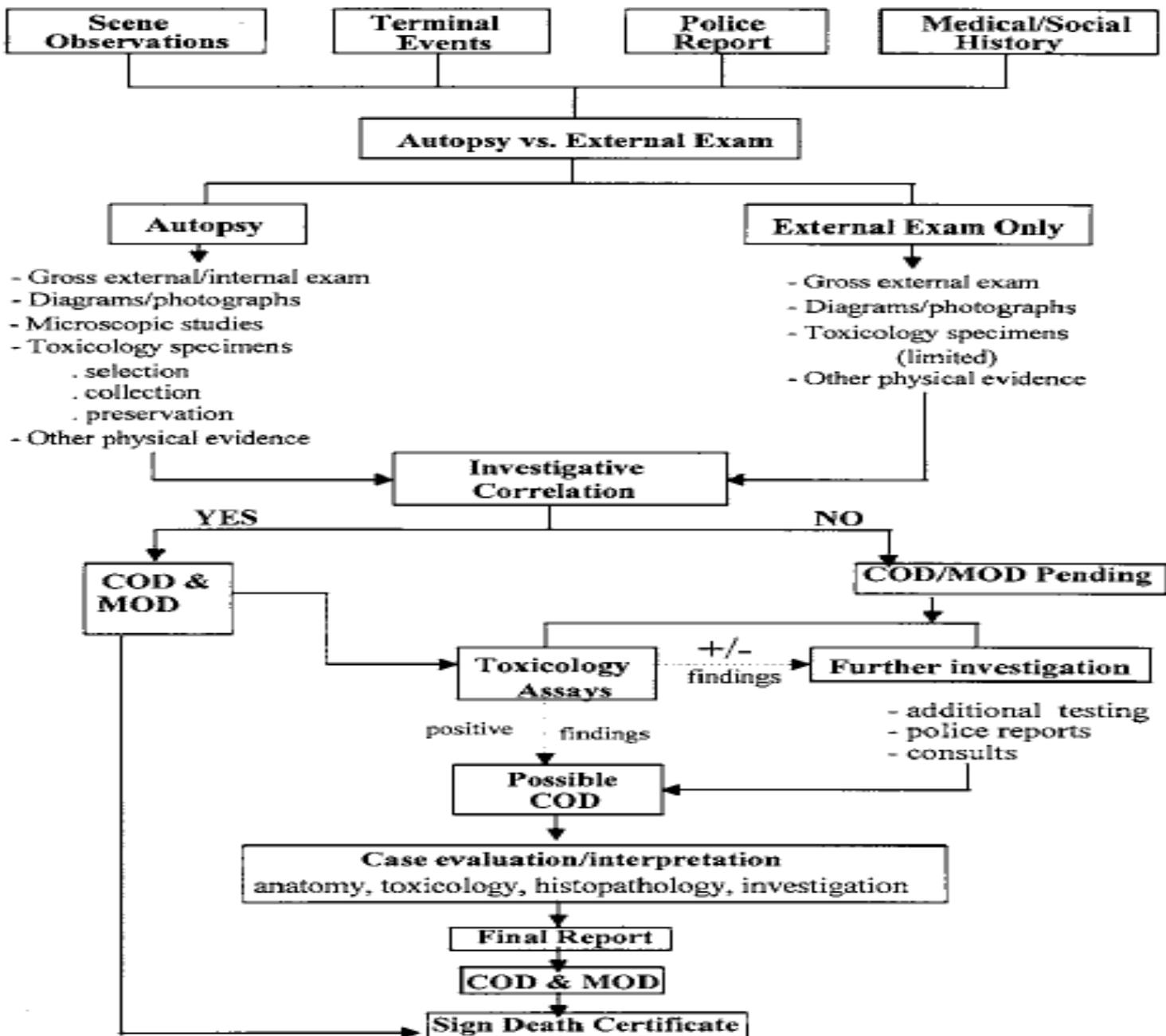
➤ *Anatomic findings elicited at autopsy are often insufficient to determine the manner of death.*

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- *In order to determine the manner of death, all available information pertaining to a particular case, including the terminal events, scene investigation, police reports, social and medical history, autopsy findings, and results of histologic and toxicologic testing, must be considered.*
 - *The question “Did alcohol, other drugs or poisons cause or contribute to this person’s death?” must always be answered.*
 - *Success in arriving at the correct conclusion depends on the combined efforts of the pathologist, the investigators and the toxicologist. The process of death investigation and the role of the laboratory is outlined in Figure.*

How might one define postmortem forensic toxicology?

- *In terms of purpose:*
- *The purpose of postmortem forensic toxicology is to perform qualitative and quantitative analysis for drugs and their metabolites, and poisons such as metals, carbon monoxide, and volatile substances in human fluids and tissues collected after death.*
- *The postmortem forensic toxicologist will then evaluate the role of drugs or poisons as either determining factors or contributory factors in the death of the individual. This includes interpretation as to what the physiological effect at time of death might have been (e.g. acute toxicity such as respiratory depression) and/or what the behavioural effect at the time of death may have been (e.g. impairment leading to drowning, motor vehicle collision or other traumatic cause of death).*

OVERVIEW OF DEATH INVESTIGATION



HOMICIDES

- *The relationship between intoxication and violence is well recognized. Toxicological studies in cases of traumatic homicide should include tests for alcohol, prescribed medications and other drugs.*
- *Negative findings can be used in court to rebut assertions of self defense against a “drug crazed” attacker.*
- *Positive findings may help to explain how the victim became involved in a physical altercation.*
- *In addition, results of drug screening provide information about the deceased’s lifestyle that may prove useful to police as they search for the murderer. Toxicological investigations may also reveal evidence that a victim was drugged to incapacitation and then murdered.*

SUICIDES

- *In cases of suicide, investigators try to discover an explanation for the act.*
- *People may be driven to suicide by*
 - *failing health,*
 - *financial problems,*
 - *loss of a loved one,*
 - *severe mental*
 - *Depression,*
 - *other causes.*

- *Drugs that can potentiate or exacerbate depression are commonly detected in suicides. Failure of antidepressant therapy may also play a role in some cases.*
- *Drugs commonly found in suicide victims, other than poisons, include alcohol, benzodiazepines, diphenhydramine, cocaine and other illegal drugs. Therefore, toxicological investigations should encompass intoxicants as well as antidepressants.*
- *Occasionally, a suicide victim employs multiple means to reduce the chances of survival. The anecdote about the man who took a lethal overdose, then climbed a ladder, placed a rope around his neck and shot himself in the head, is often not far from the truth.*

Identification of a Toxicology Issue in the Death Investigation

Is the involvement of toxic substance(s) ^{*}
a possible factor in death?

YES

Is the likely
toxic agent known?

NO

Why was analysis
requested?

YES

Proceed with specific
methods for the agent

NO

Are history and circumstances
leading to death known?

YES

Proceed with analysis for
most likely agents.

NO

Proceed with comprehensive
analysis (general unknown).

* FORENSIC QUESTIONS RELATIVE TO POISONING:

1. Was the death or illness due to a poison
2. What toxin produced the illness?
3. Was the substance employed capable of producing death?
4. Was a sufficient quantity taken to produce death or toxic results?
5. When and how was the toxin taken?
6. May a poisoning have occurred and the poison either be or have become undetectable?
7. Could the detected poison have an origin other than in poisoning?
8. Was the poisoning SUICIDAL, ACCIDENTAL, OR HOMICIDAL?
9. Were the correct specimens collected and preserved, analyzed in such a manner to answer the question at hand?

ACCIDENTS

- *Drowning,*
- *falls,*
- *fires,*
- *electrocutions,*
- *boating accidents*
- *aircraft crashes,*
- *as well as accidental drug overdoses, are included in this classification.*

➤ Accidents often result from carelessness or the impairment of mental or motor function on the part of the victim or another person. In apparent cases of accidental death, it is important to rule out alcohol or other drug induced impairment. Many insurance policies exclude death or injury resulting from the misuse of intoxicating substances, although in some cases quite the opposite is true.

➤ When a driver becomes incapacitated by a heart attack, for example, and loss of control results in an accident, toxicological studies may play a part in the investigation. Detection of intoxicants, together with other evidence, may indicate that an apparent accident was actually intentional. For example, finding large quantities of a drug(s) in a deceased person's stomach suggests that an overdose was intentional (i.e., suicide) rather than accidental.

➤ If postmortem investigation fails to detect carbon monoxide in the blood of a burn victim, or soot in the airway, it may be that the victim had already died when the fire started. Workplace accidents must always be investigated for the possible involvement of alcohol or other drugs, since there are likely to be insurance claims against the employer.

NATURAL DEATH

➤ *Apparent natural deaths may or may not require toxicological study. If the autopsy clearly reveals the cause of death, and no history of drug or alcohol misuse is known, the pathologist may decide that further toxicological study is not necessary.*

UNCLASSIFIED, UNDETERMINED OR PENDING

- *When the cause and/or manner of death remain elusive at the completion of investigations and autopsy, the case is left unclassified, pending further studies.*
- *Additional inquiries, microscopic examinations and toxicological studies are initiated to find sufficient evidence for a diagnosis.*
- *The primary goal for the toxicology laboratory is to determine whether or not toxic substances are present in the deceased in sufficient quantities to kill.*
- *If a probable toxic cause of death is identified, the laboratory gathers additional evidence to assist the pathologist in deciding how it was administered, and estimating how much was used, and how long before death.*

ROLE OF POLICE, MEDICAL EXAMINER AND INVESTIGATOR

- *When a death is reported to the medical examiner, a case investigator will obtain certain information to determine whether the case falls under the jurisdiction of the medical examiner.*
- *The following is a list of important topics to consider, which may vary according to jurisdiction.*

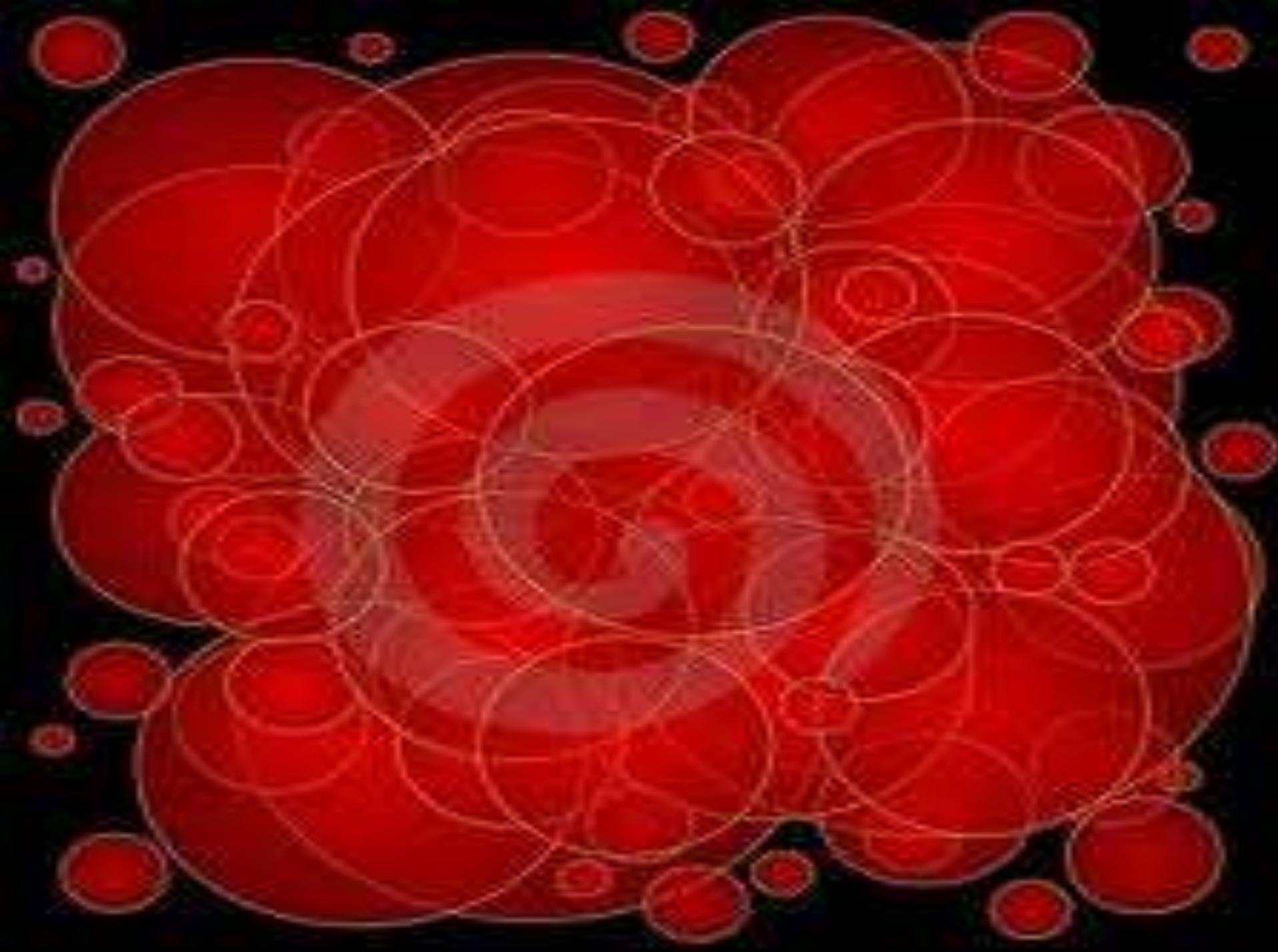
- 1. Any death where any form of violence, either criminal, suicidal, or accidental was directly responsible or contributory.
- 2. Any death caused by an unlawful act or criminal neglect.
- 3. Any death occurring in a suspicious, unusual, or unexplained fashion.
- 4. Any death where there is no attending physician.
- 5. Any death of a person confined to a public institution.
- 6. The death of any prisoner even though both the cause and manner appear to be natural.
- 7. Any death caused by or contributed to by drugs and/or other chemical poisoning or overdose.
- 8. Any sudden death of a person in apparent good health.
- 9. Any death occurring during diagnostic or therapeutic procedures.
- 10. Any fetal stillbirth in the absence of a physician.
- 11. Any death where there is insufficient medical information to explain the individual's demise.

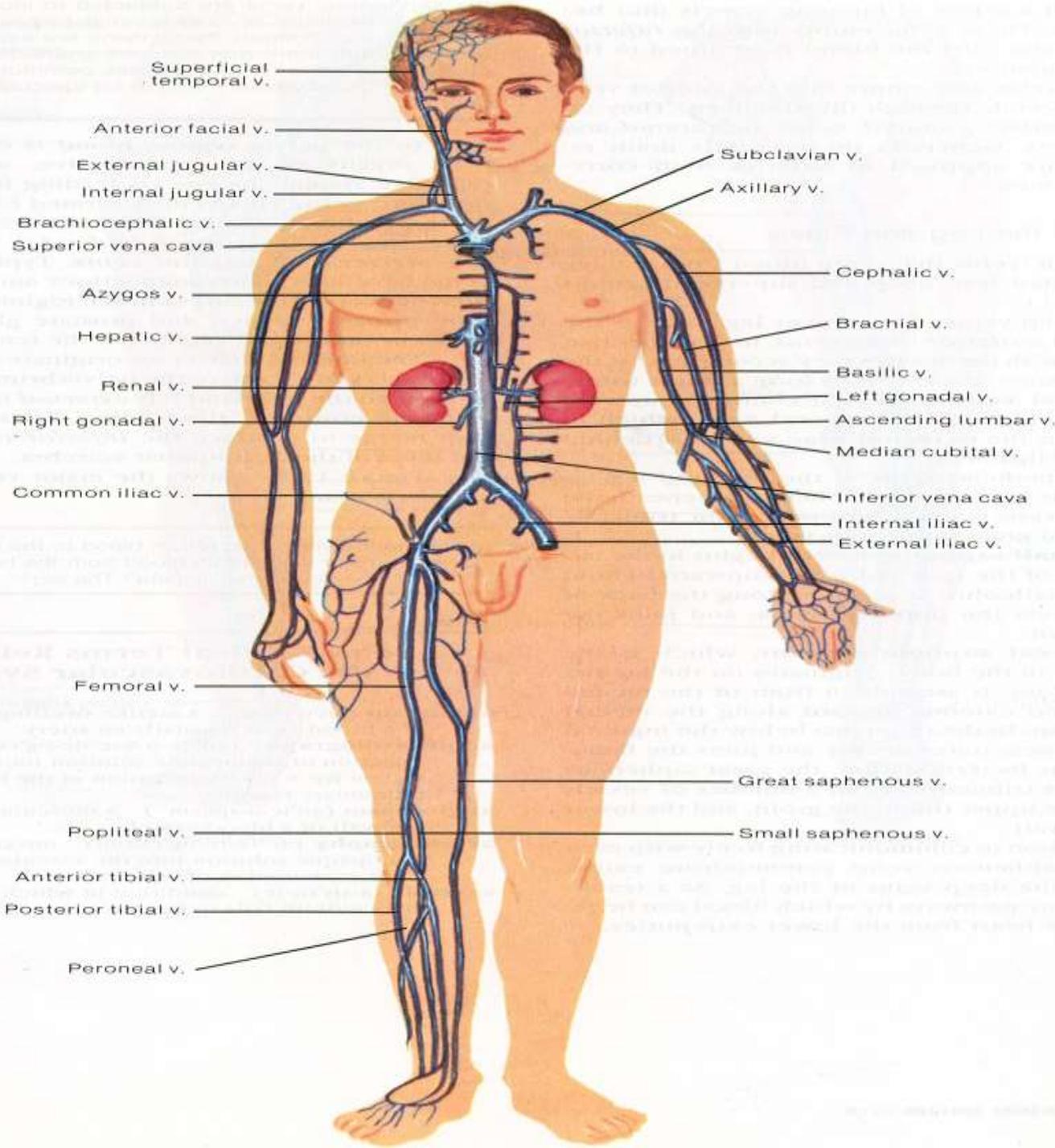
TYPICAL AUTOPSY SPECIMEN

- *Blood*
- *Urine*
- *Stomach contents*
- *Bile*
- *Liver*
- *Hair*
- *Vitreous humor*

BLOOD

- *Antemortem* → *ideal blood sample*
- *Postmortem blood is not truly “blood”*
- *Anatomical site of collection at autopsy should be noted*





➤ *Central sites*

➤ *Heart*

➤ *Peripheral sites*

➤ *Femoral*

➤ *Iliac*

➤ *Subclavian*

➤ *Other sites*

➤ *Head blood*

➤ *Hematoma*

blood

HEMATOMA

- *A hematoma, or haematoma, is a localized collection of blood outside the blood vessels, usually in liquid form within the tissue.*
- *This distinguishes it from anecchymosis, which is the spread of blood under the skin in a thin layer, commonly called a bruise.*
- *Internal bleeding is generally considered to be a spreading of blood within the abdomen or skull, not within muscle.*
- *It is not to be confused with hemangioma which is an abnormal build up of blood vessels in the skin or internal organs.*



URINE

- *Produced by the kidneys*
- *Blood filtered by the kidneys*
- *Stored in the bladder until voided*
- *Qualitative* - *the presence of a drug in the urine of an individual indicates that some time prior to death the drug or poison was present in the blood of the individual.*

STOMACH CONTENTS

- *Visual examination may reveal tablets*
- *Drugs that have been orally ingested may be detected in stomach contents*
- *Caution: drugs administered by other routes may also diffuse into stomach contents from the blood*
- *Generally qualitative:*
 - *Stomach contents are not homogeneous*
 - *Only a portion of stomach contents collected (unmixed?)*
- *Useful for directing further analysis*

➤ LIVER

- Drug metabolism occurs in the liver
- Both parent compounds and metabolites may be present in higher concentrations in the liver than in the blood → ease of detection
- Limitation is that drugs are not uniformly distributed throughout the liver → confounds interpretation

➤ BILE

- Digestive secretion
- Continuously produced by the liver
- Stored in the gallbladder
- Qualitative - the presence of a drug in the bile of an individual indicates that sometime prior to death, the individual was exposed to the drug.

Hair

- *Recent specimen of interest*
- *Metabolism does not occur in hair*
- *Can provide a historical record of drug or poison exposure*
- *Pros and cons of hair analysis still being uncovered → racial variability*

VITREOUS HUMOR

- *Fluid that occupies the space between the lens and the retina of the eye.*
- *Sequestered from putrefaction, charring and trauma, microorganisms.*
- *Useful in cases where decomposition is advanced, body is exhumed or in fire deaths.*
- *Limitation is blood:vitreous ratio may not be known.*

SPECIMEN SELECTION, COLLECTION, PRESERVATION & SECURITY

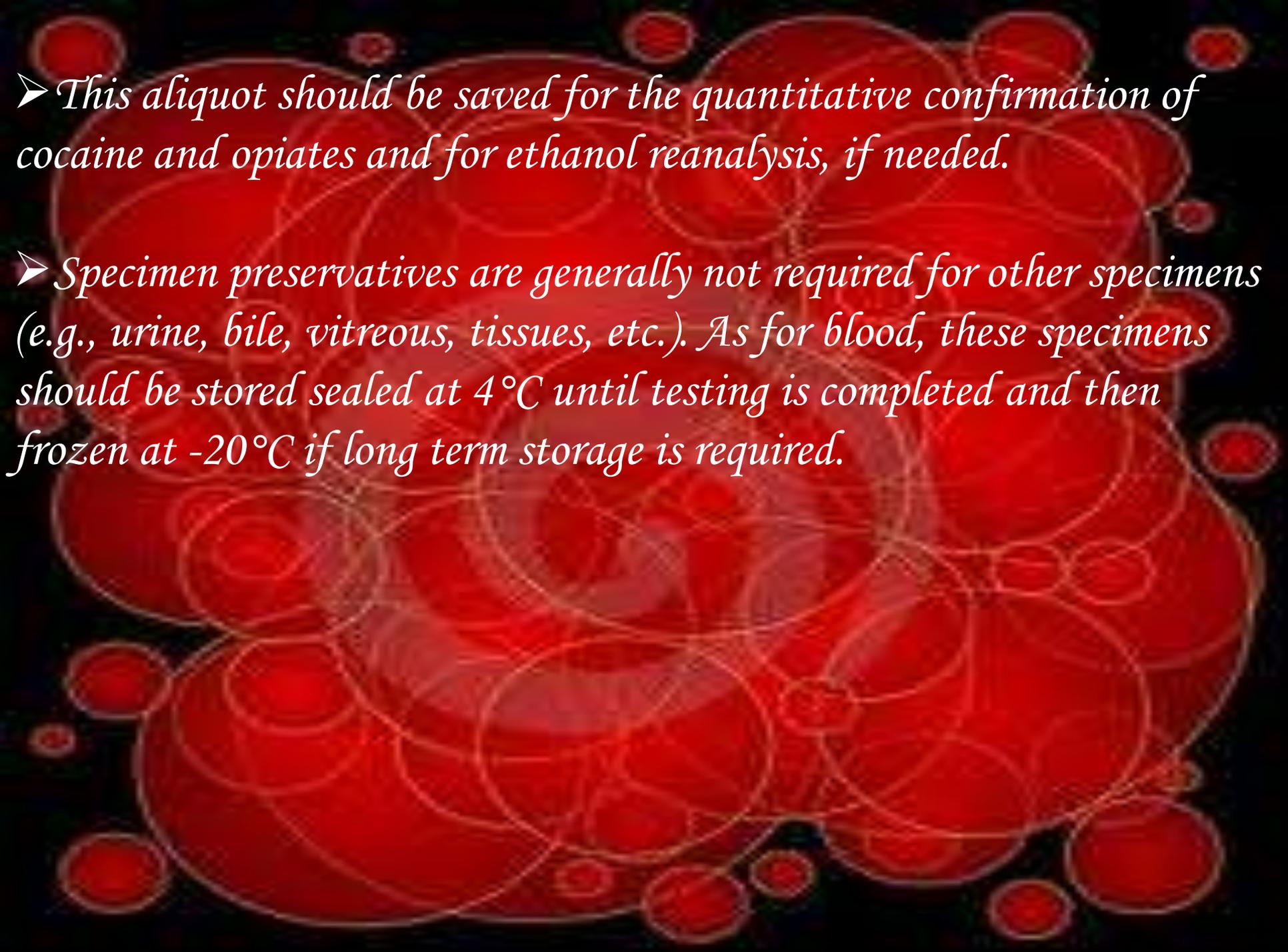
- *Identification of samples*
- *Specimens delivered to lab without delay*
- *Specimens should be analyzed as soon as possible*
- *Storage areas should be secure*

➤ *Blood specimens should be preserved by adding 2% wt/vol sodium fluoride to the collection container. Sodium fluoride is added to inhibit microorganism conversion of glucose to ethanol, microorganism oxidation of ethanol, postmortem conversion of cocaine to ecgonine methyl ester by cholinesterases, and enzymatic loss of other esters such as 6-acetylmorphine.*

➤ *Esters, subject to alkaline hydrolysis, are more stable in postmortem blood than antemortem blood because the pH of blood falls after death.*

➤ *Some laboratories may choose to add an anticoagulant such as potassium oxalate, EDTA or sodium citrate at a concentration of 5 mg/mL in addition to the fluoride preservative.*

- *Preservatives and anticoagulants may be added to collection containers designated for blood ahead of time. However, if only a small amount of blood is collected, the excess fluoride may affect headspace volatile assays by altering the vapor pressure of the analyte.*
- *Ideally, one preserved and one unpreserved blood specimen should be taken for comparison, if needed.*
- *Once collected, blood specimens should be stored in tightly sealed containers at low temperatures (4°C short-term and -20°C long-term).*
- *The low temperatures inhibit bacterial growth and generally slow reaction kinetics such as the conversion of ethanol to acetaldehyde.*

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- *This aliquot should be saved for the quantitative confirmation of cocaine and opiates and for ethanol reanalysis, if needed.*
 - *Specimen preservatives are generally not required for other specimens (e.g., urine, bile, vitreous, tissues, etc.). As for blood, these specimens should be stored sealed at 4°C until testing is completed and then frozen at -20°C if long term storage is required.*

PROPER SAMPLING, STORAGE & HANDLING

- *Not feasible to analyze specimens immediately*
- *Sample should be in well-sealed container*
- *Sample containers must be sterile*
- *Use of preservatives and anti-coagulants*
- *Refrigeration vs. Freezing*
 - *Both inhibit bacterial action; esp. freezing*
 - *Freezing results in ↑ prep time*
 - *Freezing may promote breakdown*

Table 12.2 Guide to the Collection of Routine Toxicology Specimens

Specimen	Amount	When to obtain	Comments
Blood, Heart	50-100 mL	Always	Identify source. Preserve with 2% sodium fluoride and potassium oxalate. Reserve an aliquot without preservative, if possible.
Blood, peripheral	10-25mL	For complete toxicology testing	Identify source. Use femoral or subclavian blood if possible.
Blood, clot	Whole clot	Trauma cases	
Urine	All	Always	Submit any quantity, even if < 1 mL, for immunoassay screening.
Bile	All	Always	Tie off gall-bladder to reduce contamination. Collect prior to liver.
Vitreous humor	All	Always	Combine fluid from both eyes into a single tube.

Gastric contents	All	For complete toxicology testing	Tie off stomach to reduce contamination of other viscera. Note total volume.
Liver	50 g	Always	Identify source. Deep right lobe preferred.
Kidney	50 g	Metals, ethylene glycol	
Spleen	50 g	CO, CN	Very useful when blood not available in fire deaths.
Brain, fat	50 g	Lipophilic drugs	Brain may be especially useful in infant drug deaths.
Lung	50 g	Volatile poisons	Collect in sealed container. Collect tracheal air as well.
Hair	Pen-sized bundle	Drug history, metals	Identify distal and proximal ends.

STORAGE OF SAMPLES

➤ *Preservative*

➤ *-Sodium fluoride*

➤ *Anti-coagulants*

➤ *Sodium citrate*

➤ *Potassium oxalate*

➤ *EDTA*

➤ *Heparin*

➤ *Not imperative for postmortem blood samples*

DETERMINING ANALYSIS

- *Case history*
 - *Medical history*
 - *Autopsy findings*
 - *Symptomatology*
- *Experience of the toxicologist*
- *Amount of specimen available*
- *Nature of specimens available*
- *Policies of the organization*

SPECIMEN COLLECTION

➤ *Specimen Containers*

➤ *Usually, the best container to utilize when collecting and storing postmortem biological fluids is glass. Glass is inert, does not contain any plasticizer contaminants and maximizes storage space. Plasticizer contamination is further reduced with Teflon®-lined caps.*

➤ *If drug concentrations of less than 0.010 µg/mL are expected, silation of glassware may be indicated. Disposable Pyrex® glass culture tubes are suitable for long term frozen storage and come in a variety of sizes.*

➤ *It is important that the container size chosen for each specimen will allow it to be as close to full as possible in order to minimize concerns about oxidative losses due to air trapped in the top of the container, volatile drug evaporation and “salting-out” effects from preservatives that may be added to the tube.¹ Generally 50 mL culture tubes represent the best choice for blood and urine specimens.*

ROLE OF FORENSIC PATHOLOGIST

- *The principal role of the forensic pathologist is to investigate sudden, unexpected, and violent deaths in order to determine the cause and manner of death.*
- *After autopsy, cases can often be divided into two categories; those with an anatomical cause of death and those without.*
- *Few drugs leave tell tale signs so obvious that the pathologist can determine a manner and cause of death without additional testing. Obvious exceptions include liver necrosis caused by acetaminophen, or the severely hemorrhagic gastric mucosa and smell from cyanide exposure, or coronary artery disease and cardiac enlargement in a cocaine user.*

TOXICOLOGICAL EXAMINATION

- *The toxicologic investigation begins with the preliminary identification of drugs or chemicals present in postmortem specimens. Confirmatory testing is then performed to conclusively identify the substance(s) present in the postmortem specimens.*
- *In a forensic laboratory, positive identification must be established by at least two independent analyses, each based on a different analytic principle.*
- *The next step in the process is to determine the quantity of substance in the appropriate specimens. Identifying drugs in waste fluids, such as bile and urine, is a useful undertaking.*
- *In forensic toxicology, a negative laboratory result carries the same weight as a positive result.*

CHAIN OF CUSTODY

- *One major difference between forensic and clinical toxicology is that institutions performing forensic work are held legally accountable for documenting the handling of specific evidence within the organization.*
- *This means that all evidence associated with a specific case must be kept in a secure area at all times and be accounted for during its lifetime by using a record or chain of custody (COC).*
- *Documentation should include*
 - *who handled the evidence,*
 - *what evidence was handled,*
 - *when and why the evidence was handled and*
 - *where the evidence is located at all times.*

PITFALLS OF POSTMORTEM TOXICOLOGY

➤ Autolysis

-The breakdown of cellular material by enzymes

➤ Putrefaction

-A septic/infectious process

-The destruction of soft tissues by the action of bacteria and enzymes

-Traumatic deaths may demonstrate ↑ putrefaction

➤ Fewer samples available for collection

➤ Quality of samples is diminished

➤ Putrefaction produces alcohols

-Ethanol

-Isopropanol

-Acetaldehyde

-n-propanol

POST MORTEM REDISTRIBUTION

➤ *Typically central blood samples are more prone to postmortem changes (will have greater drug concentrations than peripheral blood samples).*

MECHANISM

- *Diffusion from specific tissue sites of higher concentration (e.g. liver, myocardium, lung) to central vessels in close proximity.*
- *Diffusion of unabsorbed drug in the stomach to the heart and inferior vena cava.*
- *Analysis of both central blood and peripheral blood in cases where postmortem redistribution may be a factor.*

INCOMPLETE DISTRIBUTION

- *Site dependent differences in drug levels due to differential distribution of drugs at death.*
- *Has been noted in rapid iv drug deaths*
- *Example:*
 - *Intravenous injection of morphine between the toes*
 - *Fatal amount of drug reaches the brain*
 - *Full distribution of the morphine throughout the body has not occurred*
 - *Femoral concentration > Heart concentration*

DRUGS

- *Drugs most commonly associated with postmortem redistribution:*
 - chemically basic
 - have large volumes of distribution
- *Volume of distribution is the amount of drug in the whole body (compared to the amount of drug in the blood).*
- *If a drug has a large volume of distribution, it is stored in other fluids and tissues in the body.*

TESTS AND ANALYTICAL TECHNIQUES IN POST MORTEM TOXICOLOGY

- *Analytical toxicology is an applied science. Toxicologists must be familiar with not only the effects and toxic mechanisms involved in poisoning, but also with the metabolism of drugs, the chemical properties of parent drugs and their metabolites, and the composition of biological samples.*
- *The detection and measurement of toxicologically relevant concentrations of potent new drugs requires the use of analytical techniques on the forefront of instrumental technology.*

Comparison of Frequently Used Methods for Analysis of Biosamples

Method	Identification:						
	Specificity	Sensitivity	Multiple Drugs	Structural Analysis (Qualitative)	Quantitative Analysis	Labor	Expertise
Color tests	+	+	Yes	+	Some	+	+
UV-VIS	+	+	No	++++	Yes	++	++
IA	++	++	Some	NO	Some	+	+
GC	++	++	Yes	++	Yes	++	++
TLC	++	+	Yes	++	No	+++	+++
HPLC	++	++	Yes	++	Yes	++	++
GC/MS	++++	++++	Yes	++++	Yes	+++	++++
AAS	+++	+++	No	++	++++	+++	++++
ICP-MS	++++	++++	Yes	++++	++++	++++	++++

USEFUL COLOR TESTS

- *Trinder's Reagent*
- *Trinder's test is a simple color test that detects salicylic acid in urine or serum. It does not detect acetylsalicylic acid in gastric contents without prior hydrolysis by boiling with dilute HCl.*
- *Trinder's reagent is a mixture of ferric nitrate and mercuric chloride in dilute hydrochloric acid. It immediately produces a violet color when mixed with an equal volume of sample containing salicylate. Phenothiazines also give a positive reaction.*

FUJIWARA TESTS FOR TRICHLORO COMPOUNDS

- *A mixture of 1 ml 20% sodium hydroxide and 1 ml of pyridine at 100C yields a red or pink color with chloral hydrate or other compounds with at least two halogens bound to one Carbon.*
- *Trichloroethanol gives a yellow color. Contamination of the laboratory atmosphere with chlorinated solvents will give “false” positive results. Metabolites of carbon tetrachloride may also give a positive result with this test, but carbon tetrachloride is only partially metabolized to trichloromethyl compounds and the test may fail to detect this agent.*
- *A blank sample and a control (trichloroacetic acid) should be tested at the same time, both blank and control solutions being treated in similar fashion to the sample.*

DIPHENYLAMINE TEST FOR OXIDIZING AGENT

- *A solution of 0.5% diphenylamine in 60% sulfuric acid added to the sample or sample filtrate in a porcelain spot plate or a test tube immediately gives an intense blue color if an oxidizing agent is present.*
- *This test detects hypochlorite, chlorate, bromate, iodate, chromate, dichromate, nitrate, nitrite, permanganate, vanadate, lead (IV), or manganese (III, IV or VII).*

PLACIDYL TEST

- *One ml of sample (urine or sample filtrate) is mixed with the reagent and allowed to stand for 20 minutes.*
- *If ethchlorvynol is present, the solution turns red or pink. The reagent consists of one gram of diphenylamine dissolved in 50 ml of concentrated sulfuric acid and added slowly with stirring to 100 ml of 50% (V/V) acetic acid. The test is sufficiently sensitive to detect therapeutic concentrations.*

REINSCH TESTS FOR HEAVY METALS

- *A spiral of copper wire is first cleaned with 35% nitric acid and washed. It is then immersed in 15 ml of sample, acidified with concentrated HCl (4 ml), heated for one hour and then examined.*
- *A silver colored deposit on the copper indicates mercury, while a dark colored or black deposit is produced by arsenic, antimony, bismuth, tellurium, selenium and sulfur.*
- *Further differentiation can be made on the basis of color of the deposit, and its solubility characteristics in potassium cyanide solution.*

MICRODIFFUSION TESTS

➤ *Cyanide Test*

- *Two ml of sample are placed in a screw cap culture tube. Discs are punched from a strip of Cyantesmo paper, available from Gallard-Schlessinger Chemical Mfg. Co. in Carle Place, New York, and one disc is stuck to the adhesive in the center of a 1 cm square of cellophane tape.*
- *The sample is acidified with H_2SO_4 , the tape is placed over the mouth of the tube, with the adhesive and disc side down, and the tube is tightly capped. After 4 h at $35^\circ C$, the caps are removed and the color of the disc is compared with cyanide standards treated the same way.*
- *A pale green or yellow color is a negative result. Cyanide turns the disc blue in proportion to the concentration in the sample. Comparison of the color with standards from 0.2 to 5.0 mg/L cyanide can be used to estimate the concentration.*

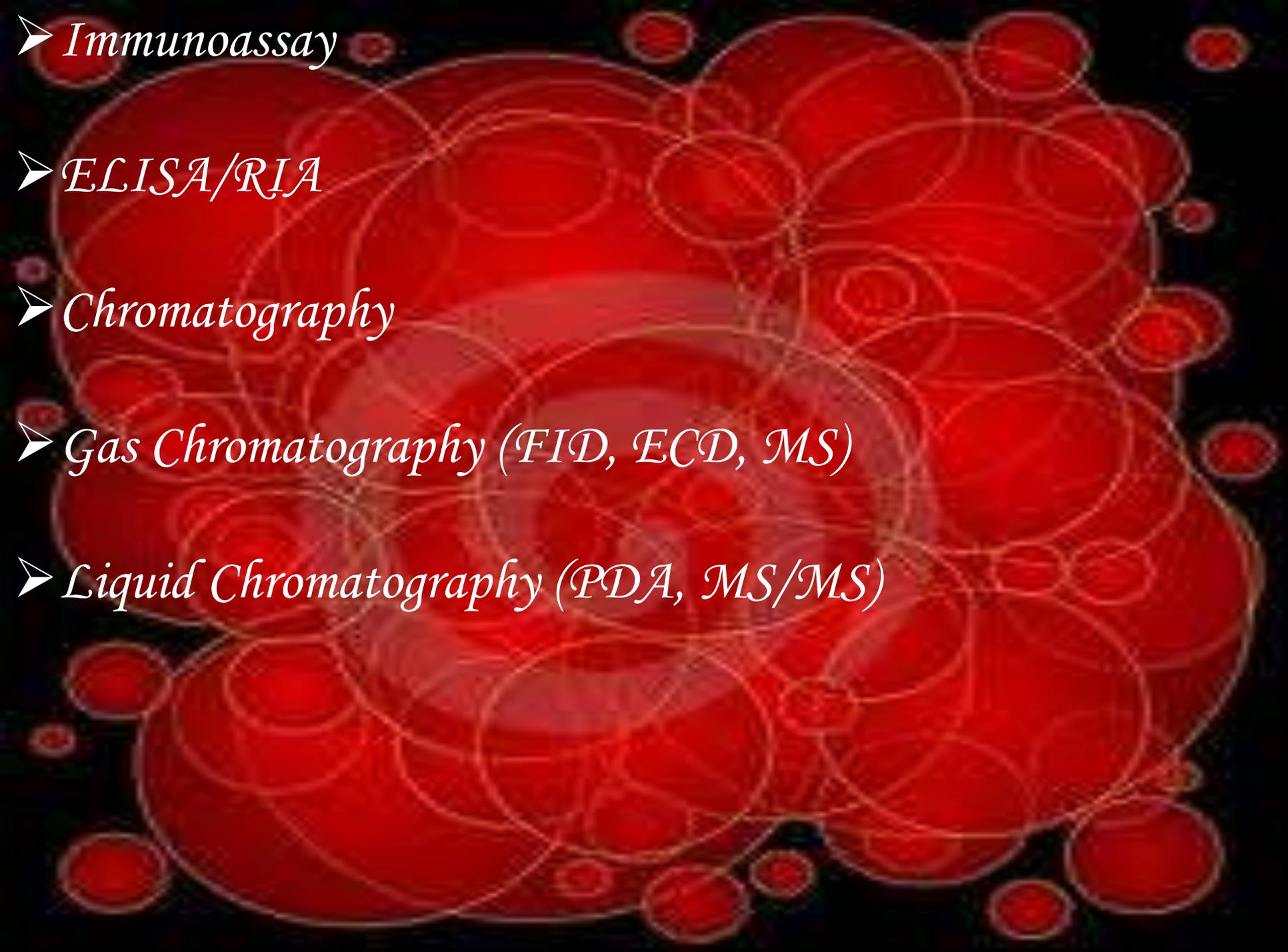
CARBON MONOXIDE

- *A simple test for carbon monoxide utilizes a procedure similar to the cyanide test described above, but using a disc of filter paper saturated with palladium chloride solution (1%) in 0.12 N HCl and dried.*
- *Carbon monoxide is released from hemoglobin by the addition of a solution containing lactic acid and potassium ferricyanide. Lead acetate is added to trap sulfide, which might interfere with the test. If carbon monoxide is present, the disc turns gray to black. While this test is simple, a faster and more effective method is to analyze the blood with a CO-Oximeter (Instrumentation Laboratories) which gives a result in % saturation of hemoglobin.*



OTHER SIMPLE TESTS

- *Glucose, Ketones, Protein, and pH via a Diagnostic Reagent Strip (Dip-Stick)*
- *Dip a strip briefly into the urine and read after 10 to 60 seconds. Elevated glucose may indicate diabetes. A positive result for ketones may indicate intoxication by acetone or isopropyl alcohol. This test may also be positive in starvation or in diabetic ketosis.*
- *Odor, Color, and pH of Gastric Content*
- *Characteristic smells may indicate the presence of substances such as camphor, cresol, cyanide, ethanol and other organic solvents, ethchlorvynol, methyl salicylate, and paraldehyde. A high pH may indicate ingestion of alkali. A green or blue color suggests the presence of iron salts. Other colors may result from dissolution of colored pills or capsules. Intact tablets or capsules should be retrieved and examined separately.*

- 
- *Immunoassay*
 - *ELISA/RIA*
 - *Chromatography*
 - *Gas Chromatography (FID, ECD, MS)*
 - *Liquid Chromatography (PDA, MS/MS)*

TOXICOLOGICAL REPORT

RESULTS:

Blood (Iliac):

Ethyl Alcohol – Not Detected⁵

Benzoylcegonine – 0.05 mg/L^{1,2,4}

Sertraline – 0.11 mg/L^{2,4}

Desmethylsertraline – 0.01 mg/L^{2,4}

Quetiapine – 0.50 mg/L

Negative for Acetaminophen, Amitriptyline, Barbiturates, Chlordiazepoxide, Citalopram, Clomipramine, Cocaethylene, Cocaine, Desipramine, Diazepam, Doxylamine, Ibuprofen, Imipramine, Meperidine, Methadone, Methamphetamine, N-desmethyltramadol, Norpropoxyphene, Pentazocine, Phenytoin, Procainamide, Procaine, Strychnine, Thioridazine, Tramadol, Trazodone, Trimipramine, Venlafaxine, and Verapamil.^{2,4}

For example use only.....Not a real report.

Thank You

