# Laboratory Services Bureau

# TOXICOLOGY

**PROVIDING THE HIGHEST QUALITY FORENSIC SCIENCE SERVICES TO THE CITY OF PHOENIX**

The Toxicology Section is part of the Phoenix Police Department Laboratory Services Bureau (LSB) and its mission is to provide excellence in toxicological analysis through the application of current forensic techniques to serve the community with integrity, innovation and impartiality. Our purpose is to accurately and reliably detect alcohol and drugs in biological samples in a timely manner, and to provide interpretation of those analytical results, including information on symptomology and driving impairment, for the criminal justice system in a manner that is efficient, reliable and unbiased.

## What is TOXICOLOGY?

- **TOXICOLOGY** is the study of the harmful effects of drugs and chemicals on biological systems.
- **FORENSIC TOXICOLOGY** deals with the application of toxicology to cases and issues where adverse effects of drug use and/or analytical results have administrative or medicolegal consequences, and where the results are likely to be used in a legal setting
- **HUMAN PERFOMANCE TOXICOLOGY** deals with the effects of alcohol and other drugs on human performance and behavior. Some case types encountered in human performance toxicology involve impaired driving, assault, homicide, and drug-facilitated crimes such as sexual assault.

### *Important Terms*

Drug: Chemical designed to have a biochemical or physiological effect

Pharmacology: The study of the effects of drugs on humans

Pharmacokinetics: how drugs move through the body (absorption, distribution, metabolism, elimination)

Pharmacodynamics: how drugs act on the body

Metabolite: Chemically changed form of a drug (can be pharmacologically active or inactive)

The **PRIMARY SERVICES** provided by Toxicology are:

## ALCOHOL ANALYSIS

◊ The amount of ethanol (alcohol) in blood samples and other biological fluids is determined using Headspace Gas Chromatography with Flame Ionization Detection (HSGC-FID).

◊ The results are reported with concentration units of grams of ethanol per 100mL, along with the uncertainty of measurement for the quantitative result.
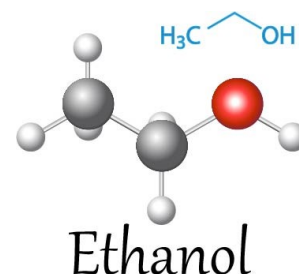
## BLOOD AND URINE DRUG ANALYSIS

⇒ Blood and urine samples are routinely tested for common drugs of abuse including illegal, prescription and over-the-counter drugs. These drugs are classified with the DECP/DRE (Drug Evaluation Classification Program/Drug Recognition Expert) into seven categories which include:

* Central Nervous System Stimulants
* Central Nervous System Depressants
* Cannabis
* Dissociative Anesthetics
* Hallucinogens
* Inhalants
* Narcotic Analgesics

⇒ Screening and confirmation, essentially two independent tests, are required for all drugs that are reported positive in a blood or urine sample. For this reason, multiple extractions may be performed on a single sample after the preliminary and secondary screens are completed. The preliminary screen performed using an immunoassay technique uses a minimal amount sample and includes an extensive 21 assay panel, which encompasses a broad range of analytes that includes both illicit and prescription drugs. Additional analytical processes are available that are able to identify more than 100 additional potential drugs of abuse.

# HOW WE PERFORM ANALYSIS OF DRUGS IN BIOLOGICAL SPECIMENS

⇒ ISOLATION—first we must isolate the drug from the matrix, typically blood or urine, and to do this we use various types of extraction methods; for example: SPE—solid phase extraction, L/L– liquid/liquid extraction, SLE—supported liquid extraction

⇒ DETECTION/CHARACTERIZATION– multiple screening methods can be used to initially detect either a category of drugs or a specific substance (analyte); these are generally referred to as preliminary results

⇒ IDENTIFICATION– confirmatory methods are used to confirm the specific analytes, these methods are very specific with multiple criteria being required for a drug to be reported as positive in the sample, including comparison to a known quality control reference material

⇒ QUANTIFICATION– determining a concentration of the substance by comparison to values of a concurrently analyzed calibration curve

# INSTRUMENTATION

We use state-of-the-art analytical techniques, much like those in hospital or research laboratories, to isolate and identify drugs from complex biological specimens. Through combinations of various analytical processes we can achieve separation and identification, in order to accurately and reliably confirm drugs in biological samples. Confirmation techniques are so precise that we refer to the resulting data as a toxicological fingerprint, being unique to one specific substance or analyte.
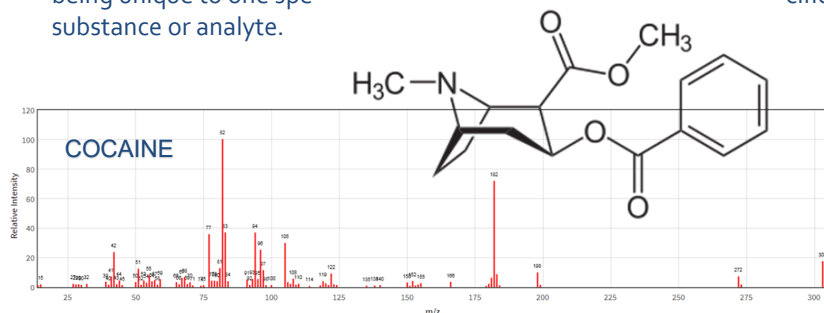


**Immunoassay (IA)**
**Gas Chromatography (GC)**
**Liquid Chromatography (LC)**
**Mass Spectrometry (MS)**
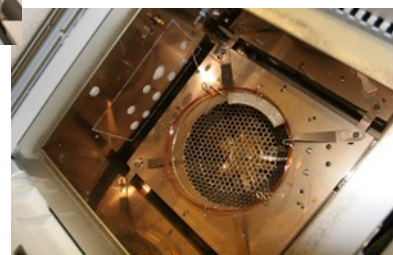
# THE LIMITATIONS of TOXICOLOGY

The results from a toxicological analysis can accurately and reliably identify specific drugs and/or metabolites in biological specimens. However, the results do not definitely provide information regarding the specific time of use, the dose administered or the route of administration. Drug may be present that fall outside of our analytical scope or may be present at concentrations lower than our current analytical capabilities .

### Staff, Education and Training

The Toxicology section consists of Forensic Scientists and Laboratory Technicians. A bachelor's degree in life science or physical science as well as a minimum of 15 credits in college level Chemistry are required to be an analyst. Trainees complete a comprehensive training program and must pass written, oral and practical competency exams prior to release to perform independent casework.

### Court Testimony

Toxicology analysts provide testimony about our knowledge, skills and training; analysis performed; methodology utilized; and our conclusions, which are based on the data from the analysis conducted. Our testimony is considered expert opinion testimony; it is up to the judge and jury to use that information to decide the outcome of a case.

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