Agilent Technologies

Providing Complete Solutions for Forensics and Toxicology

AGILENT HELPS FORENSIC SCIENTISTS AND TOXICOLOGISTS GET ANSWERS

Yes or no? Guilty or not guilty? These are the questions that forensic scientists and toxicologists answer with the help of instruments from Agilent. People's lives can hang in the balance, so the answers better be right.

Throughout the past 40 years, Agilent scientists have been working closely with customers around the world to develop progressively more robust technologies to meet their most difficult daily challenges. Recent developments enable forensic and toxicology laboratories to test and analyze increasingly smaller/fragile substances as well as dangerous designer drugs. Moreover, they can validate their results with the utmost confidence.

Three technologies form the core set of laboratory solutions used in forensics and toxicology. These include gas chromatography, liquid chromatography, and mass spectrometry, powered by sophisticated data-handling and analysis software.

Agilent's gas and liquid chromatographs, mass spectrometers, and other instruments—all recognized for their accuracy and consistency—identify illicit drugs, explosives, accelerants, and trace evidence found at crime scenes.

The company's Bioanalyzer is considered the gold standard for mitochondrial DNA analysis. That's a special form of DNA testing used by law enforcement and the military to identify badly degraded remains, such as those recovered after a natural disaster, plane crash, or from armed conflicts long since resolved.

Agilent systems also play a pivotal role in forensic toxicology—helping to determine cause of death, detecting an athlete's use of performance-enhancing drugs, or making sure workers in safety-sensitive industries such as nuclear power or mass transit aren't impaired by controlled substances.

Criminalistics

The company works closely with law enforcement agencies around the world to meet the stringent and rapidly evolving challenges faced by crime labs across multiple forensic disciplines. The company's advanced technologies are used to screen, analyzes, and characterize diverse physical evidence, including trace materials such as fiber, rope, glass, adhesive tape, gunshot or explosive residue, soil, water, combustibles, inks, dyes, paints, fingerprints, and much more. Agilent's highly efficient instruments, workflow solutions, and advanced informatics enable laboratory technicians to easily and rapidly manage large quantities of data and confidently preserve the integrity and security of their results.

Agilent is sought out as a partner by leading forensic organizations and key government agencies to help optimize laboratory processes and protocols. The company continues to drive the development of next-generation drug-testing methods, and is the first company to provide law enforcement with a comprehensive compendium for detecting designer drugs—so-called herbal incense, bath salts, and so on—formulated to get around existing definitions of illicit compounds.

Historically, investigators have used samples of blood or urine to screen for drugs, but screening saliva and hair are becoming more common. Collecting these "alternative matrices" is less invasive, and samples can be easily analyzed using Agilent's highly sensitive LC/MS/MS instrumentation.

DNA testing

With the continuing advancement of polymerase chain reaction (PCR) technology, sequence analysis of mitochondrial DNA has become a powerful tool for human identification. Testing requires only minute amounts of intact mitochondrial DNA, and can be extracted from badly degraded samples such as bone, teeth and hair, then amplified (or replicated) innumerable times with PCR technology.

Mitochondrial DNA technology is certified by the United States Department of Defense for use in the identification of war casualties and it is also the standard method used to identify human remains from terrorist attacks. Mitochondrial DNA is also used regularly in historical and anthropological studies.

KEY TECHNOLOGIES

Agilent instruments use the following technologies, often in combination, in forensic and toxicology testing.

Gas and liquid chromatography: GC and LC are processes used to separate a chemical mixture into components via either a gas phase, in which the sample is vaporized, or a liquid phase, in which the sample is dissolved in a solvent.

Mass spectrometry: MS is a way of determining the composition of a substance by measuring the masses of the various ions in a sample.

Quadrupole, triple quadrupole and time-of-flight: Quadrupole, QQQ and TOF are techniques used in mass spectrometry to filter sample ions based on a measure of their mass in ratio to their net positive or negative electrical charge.

Sports drug testing

For the 1972 Olympics, Agilent supplied instruments for the games' first drug-testing program. Since then, the company has provided increasingly more sophisticated technologies and ongoing scientific support to drug-testing laboratories serving each of the subsequent Olympics, as well as major events such as World Cup Soccer and the Tour de France.

Agilent provides drug-testing labs with specialized tools and instruments that enable scientists and technicians to identify, confirm, and quantify thousands of substances from a variety of samples. These include six classes of substances banned by the World Anti-Doping Agency: stimulants such as amphetamines and ephedrine to increase alertness; narcotics such as morphine to reduce pain sensitivity; anabolic steroids to increase bulk and strength; diuretics used to lose weight quickly and dilute urine samples for drug testing; growth hormones such as erythropoietin to increase strength and endurance; and other restricted drugs such as beta blockers used to calm nerves and reduce hand tremors.

Toxicology

Toxicology testing is used in many fields to identify and analyze the safety or toxicity of organic and inorganic substances. In law enforcement, for example, toxicology testing can be used to identify

Fourier transform infrared spectroscopy: FTIR is a technique that exploits the fact that molecules absorb specific frequencies of light depending on their characteristic structures.

Ultraviolet–visible spectroscopy: UV-VIS uses light in the visible and adjacent ranges and identifies molecules by measuring how much light they absorb or reflect.

Nuclear magnetic resonance: NMR provides information about a sample based on the resonant frequencies of its atomic nuclei.

illegal substances and drugs of abuse or define cause or manner of death. In the pharmaceutical industry, toxicology testing is required as part of the drug development process to determine the safety of specific drug candidates. Toxicology testing is also performed on water and other environmental samples, as well as in the commercial manufacturing of consumer products.

Sensitivity, reliability, and the speed at which toxicology testing and analysis is performed is extraordinarily important in the forensics and investigative fields. Whether testing for poisons, or screening for illicit drugs, Agilent empowers laboratories to meet stringent technical requirements, and perform testing and analysis worthy of legal scrutiny.

For more information, visit Agilent's Forensic & Toxicology website.