



Media Backgrounder – perspective and detail for journalists:

AGILENT TECHNOLOGIES IN SPORTS DRUG TESTING



For more than 30 years, Agilent Technologies has been a leading provider of analytical instruments for drug testing in sports. In 1972, Agilent supplied analytical instrumentation to the lab serving the first Olympic Games in which testing was required. Since then, Agilent technology has played a role with drug testing labs serving each of the Olympic Games as well as major events such as World Cup Soccer and the Tour de France.

Agilent provides instrumentation to doping control laboratories that allow scientists to identify, confirm and quantify thousands of substances in a wide variety of samples. The company does not perform the actual analysis of the samples nor is it involved in determining the regulations. In addition to instrumentation, Agilent helps labs develop methods for detecting banned substances, training, technical support and servicing/maintenance of instrumentation.

The Banned List

The World Anti-Doping Agency (WADA) has outlined six classes of prohibited substances: stimulants; narcotics; anabolic agents/steroids; diuretics; peptide hormones and related compounds; and other restricted drugs. These classes include more than 400 substances and thousands of related compounds. International sports associations and professional sport leagues usually follow the WADA guidelines with some exceptions.

Each class of drugs provides different advantages in performance and so are more likely to be used in certain sports. Likewise, each drug class is more suited for a certain type of instrument and analysis.

Stimulants

Purpose: To increase alertness and aggression and reduce fatigue during competition
Used in: Long-distance running, cycling, American football, baseball
Tested by: Gas chromatography, mass spectrometry
Examples: Amphetamines, caffeine, cocaine, ephedrine

Narcotics

Purpose: To reduce pain sensitivity during training and competition
Used in: Boxing, contact sports, other sports for faster recovery during training
Tested by: Gas chromatography, mass spectrometry
Examples: Heroin, morphine, methadone, opium

Anabolic Agents/Steroids

Purpose: To increase muscle strength and bulk during training
Used in: All sports, including weightlifting, gymnastics, track and field
Tested by: Gas and liquid chromatography, mass spectrometry
Examples: Testosterone, nandrolone, THG, beta-2 agonists

Diuretics

Purpose: To lose weight quickly, to evade doping tests by diluting urine
Used in: Sports with weight classes such as weightlifting, wrestling and boxing; may be used in all sports to attempt to hide drug use
Tested by: Gas and liquid chromatography, mass spectrometry
Examples: Dexamethasone, mannitol

Peptide Hormone and related substances

Purpose: To increase muscle strength and bulk; to increase endurance
Used in: Various sports; For example, growth hormones and factors are used in strength sports and bodybuilding, EPO for endurance events such as cycling and long-distance running
Tested by: Liquid chromatography, mass spectrometry and immunoassays; misuse can be difficult to detect reliably as these compounds occur naturally in the body
Examples: human growth hormone (HGH), erythropoietin (EPO)

Other Restricted Drugs

Purpose: Various although many are not considered to enhance performance
Used in: Various sports; For example, beta blockers are used in events requiring concentration (archery, shooting) to calm nerves and reduce hand tremors
Tested by: Gas and liquid chromatography, mass spectrometry
Examples: Marijuana, corticosteroids, beta blockers, alcohol, local anesthetics

The most commonly tested biological sample is urine because it is easier to collect adequate volumes and collection is not invasive. Drug and metabolite levels are also higher in urine than other sample types. Some types of drugs are difficult to detect in urine, however, so blood samples may be tested.

Athletes can be tested at any time and any place. When the testing is in connection with a specific athletic competition (Olympics, Pan-American Games, etc.), it is considered "in competition." When the testing is away from competition, in the off-season or during training, it is considered "out-of-competition." In this testing, the anti-doping officials arrive unannounced at the athlete's home or training center and collect a sample for subsequent analysis.

More information about the sample collection process is available on the Agilent backgrounder titled "Drug Testing: Sample Collection and Chain of Custody."

The Sample Analysis Process

Three technologies form the core of most major drug testing laboratories: gas chromatography (GC), liquid chromatography (LC) and mass spectrometry (MS). These state-of-the-art technologies are the same as those used in homeland security, forensics/criminal investigation, environmental testing, and food safety. Their extreme sensitivity makes it very difficult for drug users to evade detection. For example, they can detect anabolic steroids that were used as much as 10 months prior to competition.

Gas Chromatography (GC)



Agilent 7890A GC

When a sample is sent to a doping control laboratory, it is first screened using an Agilent 7890A GC system. Gas chromatography separates and detects the components in a sample. First, a sample is vaporized and is sent into a separation column. The compounds in the sample separate in the column and are detected one by one as they exit. The speed and sequence at which the components exit the column identify unknown compounds in the sample.

Liquid Chromatography (LC)



Agilent 1200 Series LC

Gas chromatography may not be suitable to screen for certain compounds such as peptide hormones as these compounds cannot survive the vaporizing process. In these cases, the samples are screened using liquid chromatography on an Agilent 1200 Series LC system. LC is another technique for separating and detecting sample components. It uses a liquid solvent instead of a gas (like in GC) to carry the sample into a column for separation and detection.

Mass spectrometry



Agilent 5975C GC/MS

If a banned substance is detected during screening, it goes to a mass spectrometer to confirm its chemical identity. The mass spectrometer often is directly connected to a gas chromatograph or a liquid chromatograph to form highly sensitive and specific GC/MS and LC/MS systems. The mass spectrometer measures the molecular weight of substances, generating a spectral pattern that is unique to the compound being analyzed. This chemical "fingerprint" is compared to a database of reference spectra to provide unambiguous confirmation of the compound.

Link

World Anti-Doping Agency: www.wada-ama.org