Briefing:

What is Forensic Toxicology?

Prepared by:

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What is Forensic Toxicology?

Toxicology is the study of the adverse effects of drugs and chemicals on biological systems. ***Forensic toxicology*** deals with the application of toxicology to cases and issues where those adverse effects have administrative or medico-legal consequences, and where the results are likely to be used in court. Forensic toxicology is a thoroughly ***modern science***, based on published and widely accepted scientific methods and practices, for both ***analysis*** of drugs in biological materials, and ***interpretation*** of those results. Many of the methods it employs have been derived from innovations in clinical medicine and academic laboratories throughout the world. Thousands of articles related to forensic toxicology methods, instrumentation and interpretation are published in hundreds of ***peer reviewed*** journals every year, and increase our understanding of the benefits, risks and dangers associated with use and abuse of illicit and recreational drugs, medications and alcohol. Forensic toxicology is governed through a ***professional certifying and accrediting board*** – The American Board of Forensic Toxicology (ABFT) – and promotes professional development and education through ***major professional organizations***, the Society of Forensic Toxicologists (SOFT), the American Academy of Forensic Sciences (AAFS), and international organizations such as The International Association of Forensic Toxicologists (TIAFT).

The Forensic Toxicology Council *(FTC) was formed in 2009 to represent the interests of the major professional organizations in forensic toxicology in the United States. The FTC is comprised of the senior officers and representatives of the American Board of Forensic Toxicology (ABFT)*, the Toxicology Section of the American Academy of Forensic Sciences (AAFS)*, and the Society of Forensic Toxicologists (SOFT)*. The FTC was formed specifically to provide information to government and policy makers regarding this field, and to promote the advancement and development of forensic toxicology.*

**The FTC does not speak for, or advocate policy on behalf of ABFT, AAFS, or SOFT.*

Death Investigation Toxicology (Postmortem Toxicology):

Forensic toxicologists work with pathologists, ***medical examiners and coroners*** in helping to establish the role of alcohol, drugs and poisons in the causation of death. The toxicologist ***identifies and quantifies*** the presence of drugs and chemicals in blood and tissue samples. This is done using state of the art chemical and biomedical instrumentation capable of detecting small amounts of toxic materials, positively identifying them, and accurately measuring how much is present. ***Accuracy, validity and reliability*** are essential, as this information is used in the determination of ***cause and manner of death***. Those determinations are the prerogative of the medical examiner or coroner; how-ever, the toxicologist is a key member of the team of experts that assist in that determination, ***consulting*** on pharmacology, drug

kinetics and interactions, metabolism, adverse and idiosyncratic reactions, drug tolerance, postmortem artifacts, drug stability, and other factors. The pathologist considers this information in the context of the investigative and medical history of the case, and the findings of disease or other medical conditions at autopsy. Accurately establishing the appropriate cause and manner of death has serious ***implications for public health*** and ***public safety***, and forensically reliable toxicology is an essential component of that process. Death Investigation toxicology is performed by both ***public and private*** laboratories and many private forensic laboratories provide specialized expertise and services not available in government laboratories.

Human Performance Toxicology:

Human Performance Toxicology deals with the ***effects of alcohol and drugs*** on human performance and behavior, and the medico-legal consequences of drug and alcohol use. This may include investigations of ***impaired driving***, vehicular assault and homicide, ***drug facilitated crimes*** including sexual assault, and aircraft, motor vehicle and maritime ***collision investigations***. Forensic toxicologists perform analysis of drugs and alcohol in biological samples, typically blood and urine, but increasingly in other matrices such as oral fluid, and hair, for the purposes of determining the timing, extent, and impairment resulting from different patterns of drug and alcohol use. The toxicologist uses state-of-the-art ***analytical methods***, such as are found in many research and hospital laboratories to isolate drugs from complex biological samples, prepare them for analysis through extraction and purification, then determine the identity and amount of drug present. Following the analytical phase, the forensic toxicologist provides ***interpretation*** of the result with respect to whether the dose represents typical therapeutic use, recreational use, or potential abuse, and can provide opinions about the likely effects of these patterns of use. This can include ***performance enhancement*** which occurs following the use of stimulants, and ***impairment*** from recreational or prescription medication use and misuse. Forensic toxicologists review and testify in cases of impaired driving involving alcohol and drugs, and address diverse issues such as transportation safety, drug facilitated crimes, competency, intoxication and diminished capacity. Forensic toxicologists frequently testify in court to both their findings and to their ***interpretation***. This type of testing may occur in public crime laboratories, but also may be a function of a health department in some states. Many blood alcohol and drug testing cases are performed in accredited ***private or academic*** forensic toxicology laboratories that voluntarily ***observe the same standards*** in place in the public sector.

The four disciplines of Forensic Toxicology:

Death Investigation Toxicology (Postmortem Toxicology)

Human Performance Toxicology

Doping Control

Forensic Workplace Drug Testing

Additionally, most states have thousands of alcohol breath testing operators which function under certification from a wide variety of state systems. Alcohol breath calibration laboratories are also beginning to be accredited under ASCLD-LAB and ISO 17025. Alcohol breath testing produces evidence in DUI and impairment cases but is also integral in workplace drug testing.

Doping Control:

Governing bodies of most competitive and intramural ***sports*** have derived rules regarding performance enhancing drug use to protect the ***health and welfare*** of the amateur and professional athletes, to maintain a fair and ***even competitive standard***, and avoid wagering ***fraud***. This applies to

both human and animal sports. International groups such as the International Olympic Committee (IOC), the World Anti-Doping Agency (WADA), and the International Federation of Horseracing Authorities (IFHA) work to update and maintain these lists as patterns of drug use change. Enforcing these rules requires peri[illegible] off-season random and event-focused drug testing for performance enhancing drugs, and other medications that appear on the organizations prohibited substances lists. Forensic toxicologists in this field use many of the same ***high performance analytical methods*** to detect current and historical use of banned substances, including stimulants, anabolic steroids, and diuretics. This type of testing occurs in commercial and public accredited laboratories around the world, though there is also testing of high-school, college and other athletes that occurs in private laboratories.

Forensic Workplace Drug Testing:

Use of drugs by people in the workplace has significant ***safety*** and ***economic*** consequences. Consequently, in the United States, workers in safety sensitive positions are prohibited from using recreational drugs or taking certain medications without a prescription. Enforcing these standards requires pre-employment, random, and for-cause ***drug testing***, such as following an accident or a transportation collision. Members of the US ***military***, employees working for the Federal Government, or their contractors are also required to comply with these standards set forth in the Drug-Free Workplace Act adopted by Congress in 1988. Forensic toxicologists perform testing of urine samples in these laboratories ***regulated and inspected*** on behalf of the Federal Government in a program managed by the Substance Abuse and Mental Health Services Administration (SAMHSA). Testing for five major classes of abused drugs and their metabolites, these scientists employ highly uniform and well-defined ***techniques and methods*** to minimize the risk of errors, and ensure that employees are treated fairly and that testing is done to the highest ***forensic standards***. The majority of workplace drug testing is not covered directly by accreditation programs however. These [illegible]egulated programs can perform tests using other matrices such as oral fluid, sweat and hair.

A related subset of workplace testing is for **parole and probation** both at the state and federal levels. This testing is often conducted with methods similar to workplace samples but is applicable to the criminal system in the management of parolees. Outside of the military, almost all of this testing occurs in commercial laboratories.

Promoting Scientific Excellence and Professional Standards in Forensic Toxicology

In 2009, the FTC established a scientific working group in fo[illegible]ic toxicology (SWGTOX) to organize efforts to advance and standardize the practice of forensic toxicology in US laboratories. The activities of SWGTOX are discussed below. The FTC received funding support from the National Institute of justice (NIJ) to launch SWGTOX which had its inaugural workgroup meetings in February 2009.

SOFT and the ***AAFS*** Toxicology Section developed a guidance document in the 1990's to identify good practices in forensic toxicology related to quality control and quality assurance, method selection and operation, instrument and equipment maintenance, staff qualifications and training, documentation of results, and laboratory management and safety. These guidelines became the basis for the develop-

The SOFT/AAFS Laboratory Guidelines are available at:

http://www.soft-tox.org/?pn=publications&sp=Laboratory_Guidelines

ment of a ***laboratory accreditation program*** implemented by ***ABFT*** in 1996. Currently 26 forensic toxicology laboratories are accredited.

The **National Laboratory Certification Program** (NLCP) currently accredits 38 regulated workplace laboratories. These laboratories are inspected and evaluated under federal guidelines. Again these guidelines address good practices for forensic toxicology and quality control and assurance.

The SOFT/AAFS Laboratory Guidelines committee has continued to review and update the guidelines, and the most recent version was updated in 2006. ABFT continues to work with the SOFT/AAFS committee in its revisions to the ABFT inspection checklist to account for developments in technology, instrumentation and standards of practice.

In 2009, ABFT began the process of aligning its laboratory accreditation program with ISO/IEC standards. Both ISO 17025 (Testing and Calibration Laboratories), and ISO 15189 (Clinical Laboratories) were evaluated, and ABFT is pursuing ISO 15189 as a template for this ISO accreditation.

SWGTOX –

www.SWGTOX.org

SWGTOX was constituted by the FTC in October 2009, at the annual SOFT meeting in Oklahoma City. The mission of the SWGTOX is to investigate, analyze, develop and disseminate consensus in standards of practice for forensic toxicology. The scope of SWGTOX activities includes post-mortem and human performance toxicology. While the standards developed by SWGTOX are considered good standard practice in all forensic toxicology disciplines, the scope of SWGTOX activities does not necessarily include those specialized areas where mandated, codified rules and regulations already exist (*e.g.*, Federal Drug-Free Workplace Program and the World Anti-Doping Agency).

These committees conduct business through established subcommittees and task groups to focus on specific aspects of the SWGTOX mission. The objectives of the SWGTOX are to establish minimum standards the practice of forensic toxicology in the following areas 1) Standards, practice, protocols including quality assurance and quality control, 2) Educational requirements, 3) Accreditation (laboratory compliance with standards of practice), and 4) Certification (individual compliance with educational and experience standard to practice forensic toxicology). SWGTOX will also establish a uniform Code of Ethics for forensic toxicologists, identify areas of research and development in the field of forensic toxicology, and promote public awareness of the field of forensic toxicology through outreach.

The three committees of SWG-Tox:

Standards, Practices, Protocols and Accreditation

Education, Ethics, Outreach and Certification

Research, Development, Testing and Evaluation

What professional groups represent Forensic Toxicology?

The American Academy of Forensic Sciences (AAFS) – Toxicology Section –

www.aafs.org

AAFS is a multidisciplinary organization representing forensic sciences in the United States. AAFS has over 6000 members who are engaged in the practice of forensic science or in training in this field. AAFS promotes professional development, research, sharing of information, professional networking, and recognition of leadership and service in the forensic science community. AAFS publishes a peer-reviewed Journal – the *Journal of Forensic Sciences*. The AAFS Toxicology Section provides training and education activities for its members, governs committees

dedicated to the advancement of forensic toxicology sub-disciplines and promotes the advancement of knowledge in the field.

The American Board of Forensic Toxicology (ABFT) –

www.abft.org

Established in 1975 as a professional certification Board for the discipline of forensic toxicology, ABFT certifies appropriately qualifyied individuals as professional toxicologists. The criteria for certification are education, experience, successful completion of an examination, and documented continuing professional education. Certification is awarded at the Diplomate (PhD) level and Forensic Toxicology Specialist (non-PhD) level. Currently there are 220 Board certified forensic toxicologists in the United States and internationally. ABFT maintains and enforces a code of ethics for its certificants. ABFT also offers accreditation to forensic toxicology laboratories, based on compliance with a comprehensive checklist, participation in proficiency testing programs, and on-site inspections and re-inspections. ABFT is accredited by the Forensic Specialties Accreditation Board (FSAB).

Society of Forensic Toxicologists (SOFT) –

www.soft-tox.org

SOFT is a professional membership organization for forensic toxicology professionals with more than 900 members. It holds an annual meeting for the presentation of research and case reports, new analytical methods and data analysis. Its abstracts are peer reviewed. SOFT publishes annually a special issue of the *Journal of Analytical Toxicology* featuring leading developments in the field. SOFT also maintains committees charged with the development of standards for analytical toxicology laboratories, which collaborates with ABFT and AAFS. SOFT and AAFS have jointly prepared a document on Laboratory Guidelines designed to promote consistent minimum standards of practice. These guidelines became the basis for the ABFT Laboratory Accreditation checklist.

Forensic Toxicology Council (FTC) –

The FTC was formed in 2009 to coordinate the efforts of the leadership of the three organizations described above, to ensure consistency in plans for professional development of the field, a unified voice for forensic toxicology on matters related to legislative or regulatory action governing forensic toxicology laboratories, and to manage projects that require the joint efforts of the three organizations specifically the development of a SWGTOX. The FTC membership is comprised of the ranking officers of SOFT, ABFT and the AAFS Toxicology section along with the representatives of SOFT and ABFT to the Consortium of Forensic Science Organizations (CFSO).

Other –

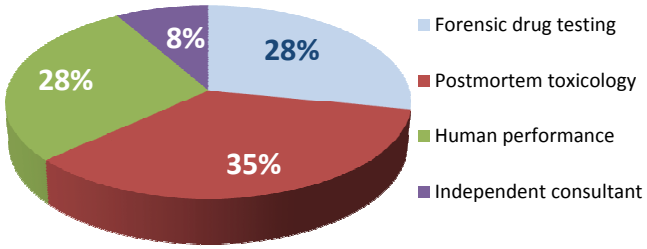
Various regional forensic science and forensic toxicology groups exist around the United States, and have local meetings and trainings. The membership of these regional groups overlaps significantly with the above organizations.

Forensic Toxicology Statistics

SOFT recently surveyed the toxicology community to better understand the nature of the profession. These figures represent preliminary results of these efforts.

Self reported type of laboratory

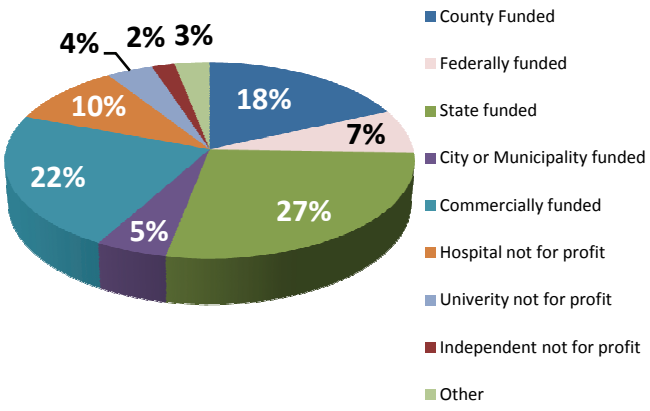
Laboratories were asked how they would characterize their laboratory. It should be noted that many laboratories handle multiple types of work. This is as a percentage of laboratories not as a percentage of the work.



Less than 1% of responses indicated doping control.

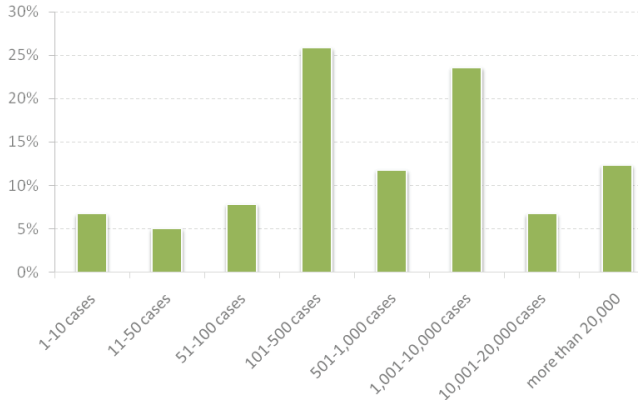
Funding or business model of laboratory

Laboratories were asked how they are funded. Again, laboratories may have multiple sources of funding. This also indicates **41%** of toxicology laboratories responding are **other than publicly funded**.



Volume of samples (Monthly workload)

It is very difficult to get accurate numbers that reflect the total workload in toxicology due to the variability in how cases and samples are counted. However, approximately **6.5 million workplace** samples are tested under federal regulation and an additional estimated **50 million non-regulated** workplace samples are tested annually. Of the laboratories responding, there is a broad distribution of workloads from only 1 case per month to the highest reporting 260,000 samples per month.



Laboratory Accreditation

Only a few states (New York, Texas and Oklahoma) and Federal programs require laboratory accreditation. Not all forensic toxicology laboratories are accredited; however on a largely voluntary basis accreditation is well established in the field under a number of programs. Many laboratories participate in more than one program.

Percentage of laboratories reporting participation in accreditation programs	
American Board of Forensic Toxicology (ABFT)	**24%**
ISO 17025	**15%**
ISO 15189	**1%**
ISO 17011	**0%**
National Laboratory Certification Program (NLCP)	**20%**
ASCLD-LAB (legacy)	**18%**
CLIA	**21%**
College of American Pathologists (CAP)	**30%**
State programs (including alcohol accreditations)	**22%**
Department of Defense (military drug screening)	**3%**
No accreditation	**12%**

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Additional information can be obtained from members of the FTC, SWGTOX, and their related organizations by contacting:

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