New Technology Could Revolutionise Drug Screening In Criminal Justice System

Dr Paul Yates, Business Development Manager at Intelligent Fingerprinting – a UK company which has invented a new non-invasive drug-testing device – says current drug screening methods present significant drawbacks and that new technology could revolutionise drug screening in the criminal justice system...

Drug Misuse

The effects of drug misuse on our society are wide ranging and increasingly well understood. As well as there being an indisputable link between drugs and crime, misuse is directly associated with many other problems, such as family breakdowns, anti-social behaviour, needle-transmitted diseases, prostitution and overdose deaths.

The wider impact of drug misuse is huge and often difficult to quantify, such as increased risk of accidents and loss of productivity in the workplace or the cost of treatment and rehabilitation of drug users. However, the Home Office estimates that drug related crime alone costs the UK £13.9bn per year[1] and offenders who use heroin, cocaine or crack cocaine commit between a third and a half of all acquisitive crimes[2].

Drug Screening

In support of strategies to tackle this growing problem, the screening of individuals suspected of drug misuse is a routine part of policing and offender management, drug treatment and rehabilitation as well as in the workplace. Many different drug tests have been developed enabling screening to be carried out on body fluids such as blood, urine or saliva, with hair analysis occasionally being used where a longer term indication of drug use is of interest. However, all of these tests have significant drawbacks associated with them, including the need to collect invasive samples, biohazard risks, and the need for frozen or cold sample storage and transport. It is also essential to establish sample collection and analysis procedures that are tamper-proof and prevent sample mix-ups to ensure a watertight chain of evidence continuity should the results be required for evidential purposes. As a result, a new, easy to use and non-invasive means of drug screening could be of significant interest to the police and the Home Office and could open up other applications for drug screening.

Intelligent Fingerprinting

Intelligent Fingerprinting, a spin-out company from the University of East Anglia, has designed the world's first device that requires only a fingerprint sample to screen for commonly abused groups of drugs.

This entirely new method for drug screening addresses many common problems associated with conventional tests and provides new opportunities to improve the wider effectiveness of drug screening regimes.

How it works

The revolutionary technique works by imaging a fingerprint at the same time as analysing the sweat residue of the fingerprint for chemicals known as metabolites, which are produced by the body as a result of normal metabolic processes. Detecting drug metabolites reveals information about recent drug use; further, because the technique detects the drug metabolites rather than the drugs themselves, a positive result proves that the person being screened has taken the drug and not simply touched a contaminated surface.

A closer look

Whenever a person touches a surface, they leave behind secretions from glands in the skin on their fingertips. These secretions are generally termed as sweat and contain a wide range of substances, including metabolites. The analysis of metabolites can be used to identify the substances with which a person has come into intimate contact through ingestion, injection or other means. Specific metabolites derive from the particular substances that have been metabolised. For example, a metabolite of nicotine is a chemical called cotinine. During the development of the technique, researchers at Intelligent Fingerprinting found that they could detect cotinine from analysis of fingerprints collected from volunteers who were smokers, often many hours after their last cigarette had been smoked. Building on this success, Intelligent Fingerprinting has developed similar tests that are able to detect the most common drugs of abuse, for example to screen for cocaine they have devised a test that detects the chemical benzoylecgonine, the metabolite of cocaine.

Analysis with a portable screening device

Alongside development of their fingerprint drug detection chemistry, scientists and engineers at Intelligent Fingerprinting have designed and developed a portable screening device that will enable a single collected fingerprint to be analysed in less than ten minutes for up to five drugs of abuse, using disposable sample collection and analysis cartridges. Operators will need very little training and no specialist expertise to operate the automated device.

The device can be calibrated to give a pass/fail reading for different levels of drug metabolite concentrations. This will enable it to be used to support a variety of drug screening scenarios where the tolerances for detected drug levels within the person being screened are different – for example, roadside screening versus drug rehabilitation.

Nanoparticle technology

To detect the metabolites present in a fingerprint, the Intelligent Fingerprinting technique uses reagents made from antibody-coated nanoparticles. Reagents are chemicals which indicate a positive result by reacting in a certain way if target substances are present. Particular antibodies are chosen to target the specific drug metabolites within the fingerprint sweat. As already noted, an antibody that reacts with benzoylecgonine could be used to detect evidence of cocaine usage. To detect drugs in fingerprints, a series of fluorescent nanoparticles are used (see Fig. 1). Nanoparticle reagents have been developed with antibodies that target metabolites of the most commonly abused drugs, including benzodiazapines, cannabis, cocaine, heroin and amphetamines such as ecstasy, allowing the Intelligent Fingerprinting technique to be used for a wide range of drug screening applications.

Practical Benefits

Intelligent Fingerprinting's technique has many practical benefits, particularly within the criminal justice field. As well as screening for drug use, collected fingerprints can be used for identification purposes either through direct matching to an individual taking the test, or by speculative searching against offender databases when needed.

A major and unique benefit of this test is that it is non-invasive. Also, unlike tests involving blood or urine samples, it does not require specialist sample collectors or pre-prepared collection areas. Once collected, the fingerprint samples can be analysed immediately using the portable device, or stored at ambient temperature for later examination. The inherent ability to directly match the detection of the drug metabolites to the sample donor's fingerprint establishes a watertight chain of evidence continuity that means that the Intelligent Fingerprinting technique is almost impossible to cheat.

Applications

There are many potential applications for Intelligent Fingerprinting's drug screening technology within the criminal justice arena, including:

- Crime Scenes – Provision of intelligence from suspect latent fingerprints that could support the building of offender profiles.
- Roadside Screening – Rapid and easy determination of recent drug misuse that could assist in the corroboration of drug-driving allegations.
- Custody Screening – Contributing to drug crime investigations and identification of potential health and safety issues associated with the detention of arrestees.
- Drug Facilitated Sexual Assault – Detection of so-called 'date rape' drug usage from victim's fingerprints or from latent fingerprints collected from the crime scene.

Away from criminal justice, the technology could also be used to support mandatory drug screening within prisons, the military or safety-critical industries. It also has potential within homeland security, as part of boarding security procedures, for identifying individuals who might have had recent contact with explosives or ammunition, by screening for the corresponding metabolites.

Development Plans

Intelligent Fingerprinting is currently finalising the development of its first commercially available version of the portable screening device and drug detection reagents. Pilot drug screening projects using the new technology will take place in early 2014 within the prison service and drug rehabilitation centres, widening out into other areas as commercial production increases. Further drug detection reagents will be produced alongside ongoing device development to align with regulatory requirements that will ultimately allow the benefits of the Intelligent Fingerprinting technology to be employed wherever drug screening is required.

Summary

It is clear that there is a well-established relationship between illicit drug use and crime, and that current methods and technology available for drug screening are limited, presenting various constraints.

Overcoming these challenges, Intelligent

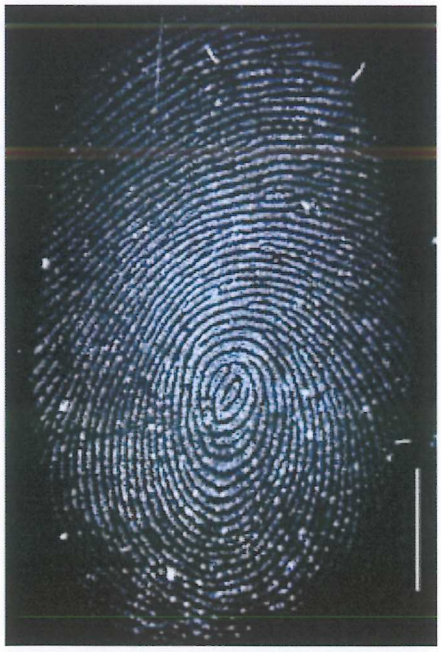
Fingerprinting's pioneering nanoparticle technology is set to revolutionise the criminal justice arena, with a host of potential uses to support non-invasive and fast drug screening within many criminal justice applications.

FOOTNOTES

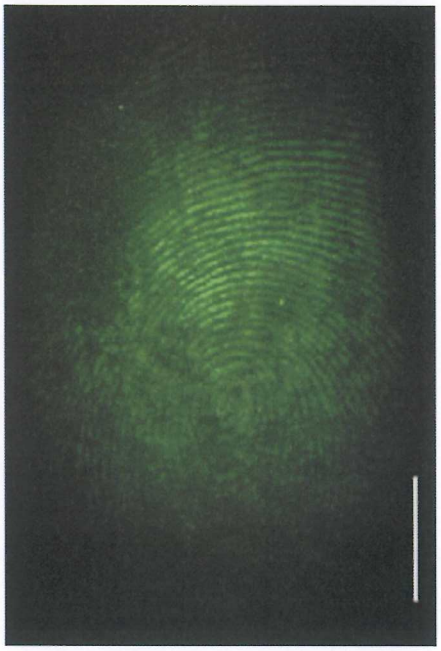
1. Singleton, N., Murray, R. and Tinsley, L. (2006).Measuring Different Aspects of Problem Drug use: Methodological developments. Home Office Online Report 16/06. London: Home Office. Available from: http://www.drugslibrary.stir.ac.uk/documents/rdsolr1606.pdf [Accessed 6th March 2012].

2. MacDonald, Z. Tinsley, L., Collingwood, J., Jamieson, P. and Pudney, S. (2005). Measuring the Harm from Illegal Drugs Using the Drug Harm Index. Home Office Online Report 24/05.

Image of a fingerprint before and after screening with the Intelligent Fingerprinting drug detection technique. The first image shows a fingerprint before screening and clearly illustrates



the ridge structure that makes each print unique to the individual. The second image shows the same fingerprint



but after application of the Intelligent Fingerprinting drug detection reagents. In this sample the nanoparticles in the reagent are coated with cotinine antibodies and a green fluorescent dye. The green colour of the fingerprint when viewed at the wavelength corresponding to the dye activation confirms that the fingerprint contains cotinine – a metabolite of nicotine – and therefore that the donor of the fingerprint has recently smoked a cigarette. Similar nanoparticles have been made with antibodies to detect the metabolites of all of the common drugs of abuse, allowing the Intelligent Fingerprinting technique to be used to screen a single collected fingerprint for evidence of drug misuse.

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With over 17 years' experience working within the UK Criminal Justice System in the area of forensics, Paul joined Intelligent Fingerprinting in 2011, heading up business development of the company's unique fingerprint drug detection device.

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