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GAZETTE

O&A
MEET THE
NEW RCMP
COMMISSIONER P. 6

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NO EASY FIX

WRESTLING
WITH TODAY'S
DRUGS OF
CHOICE

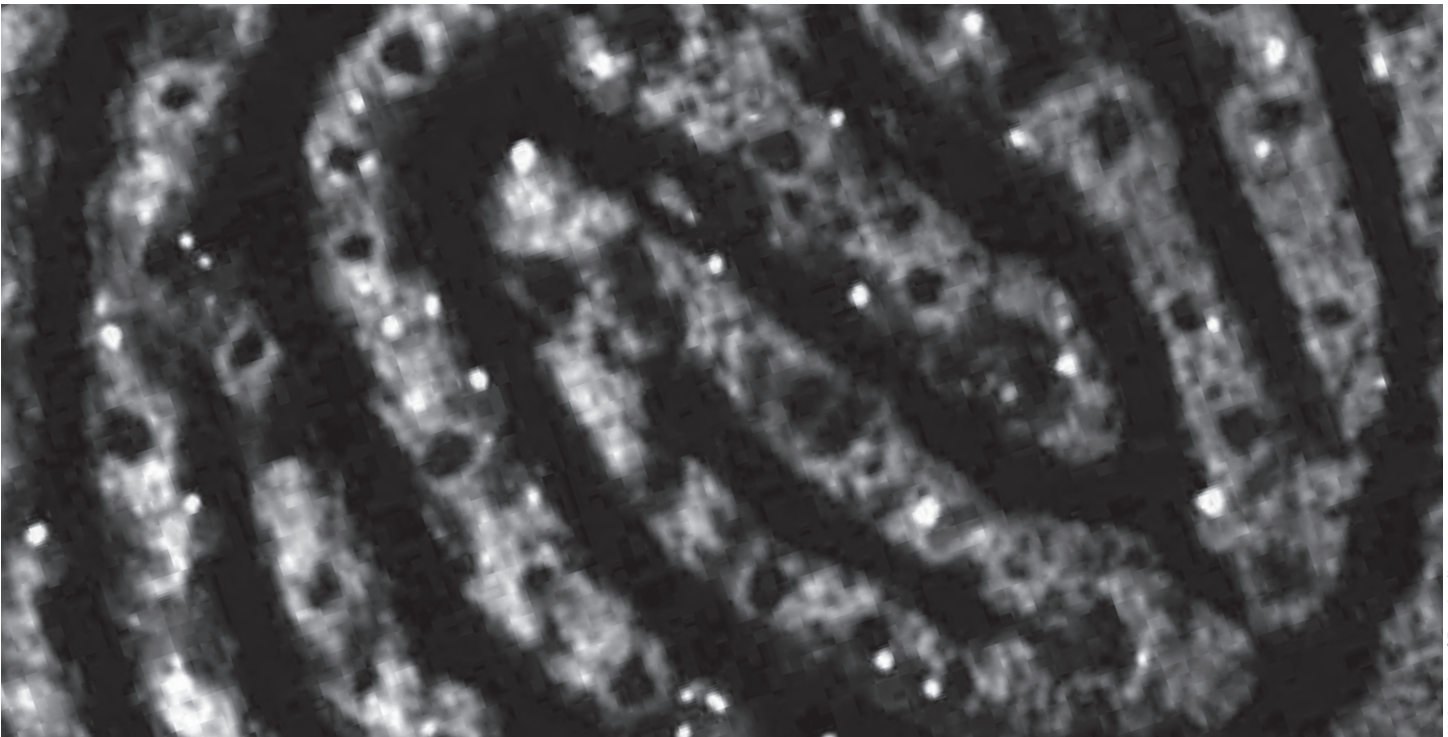
**CHEMICAL
KNOW-HOW**
TACKLING THE SYNTHETIC
DRUG SCOURGE P. 8

**PRESCRIPTION
DRUGS**
TASK FORCE SEEKS
SOLUTIONS FOR
OXYCODONE ABUSE P. 18

**MOBILE
TECHNOLOGY**
NEW DEVICE
DETECTS DRUG
METABOLITES FROM
FINGERPRINTS P. 20

**SOCIAL-MEDIA
SAVVY**
TWEETING DURING
A NATURAL DISASTER P. 34





University of East Anglia

Close-up results of a positive test. A change in colour shows detection of the drug metabolite and can be seen in direct association with the sweat pores that comprise the fingerprint pattern.

DRUG DETECTION FROM FINGERPRINTS

NEW TECHNOLOGY TESTS DRUG METABOLITES IN SWEAT

Dr. Paul Yates, Intelligent Fingerprinting Ltd, Norwich, U.K.

The effects of illegal drug use on society are wide ranging and increasingly well documented. In addition to the direct link between drug abuse and violent crime, it's also associated with many wider social problems and impacts the workplace through loss of productivity and increased risk of accidents.

Notwithstanding the less tangible damage that drug use causes to society, the actual costs in terms of stolen property, investigating and prosecuting drug-related crime, loss of workplace productivity, and treating and rehabilitating drug users, are estimated in the many billions of dollars per year.

As a result, testing individuals suspected of drug abuse has become a routine part of policing, the workplace, drug treatment and rehabilitation, with many different testing methods being available.

Drug testing from samples of body fluids such as blood, urine and more recently saliva are the most commonly employed, with hair analysis also being occasionally used when a longer term indication of drug misuse is of interest.

All of these tests have drawbacks associated with them including the need to collect invasive samples, the biohazard risk, cross reactivity to other substances in the sample, or the requirement for frozen or cold sample transport and storage. It's also crucial to put in place collection and analysis procedures that prevent tampering of the tests and ensure a watertight chain of evidence continuity should the tests results be needed for evidential purposes.

INTELLIGENT FINGERPRINTING

Researchers led by Professor David Russell at the University of East Anglia in Norwich, United Kingdom, have developed a technique that can detect drug metabolites from the sweat deposited within a fingerprint, while at the same time allowing high-definition imaging of the fingerprint itself.

Metabolites are chemicals that are produced in the body as the result of normal metabolic processes, and can be used to determine what substances a person has ingested or come into intimate contact with. The

Intelligent Fingerprinting technique allows the non-invasive collection and analysis of fingerprints with a mobile hand-held device in only a matter of minutes, needs no sample preparation or specialist handling, presents no biohazards and because of the ability to image the fingerprint of the sample donor, has an inbuilt chain of evidence continuity.

The method works by using sub-millimetre sized nanoparticles that are coated with antibody chemicals and a fluorescent coloured dye. The nanoparticles (made of either iron oxide or gold) are mixed into water and applied to the surface of the fingerprint where the antibodies react with their target drug metabolites, thereby binding the nanoparticles and fluorescent dye to the fingerprint itself.

The target drug metabolite can be detected through the observed colour change, and developing the high-definition fingerprint image can be used for identification purposes using conventional comparison procedures.

Different antibodies are used to target



the metabolites of different drugs, and so far the researchers have been able to detect the following drugs of abuse:

- Benzoyllecgonine (cocaine metabolite)
- Ethylidine Dimethyl Diphenylpyrrolidine (methadone metabolite)
- Morphine (heroin metabolite)
- Tetrahydrocannabinol (the main psychoactive substance found in a cannabis plant)

In addition, the technique has also been used to detect cotinine — the metabolite of nicotine — and cortisol, a hormone present in fingerprint sweat that is related to the stress levels of individual being tested.

Research is underway to broaden the number of drugs that can be tested to see if the technique can be used to identify individuals who might have had recent intimate contact with explosives.

DEALING WITH CONTAMINATION

Like other drug-testing techniques, the use of sweat has been fallible to producing a positive result by innocent contamination, either by touching a surface coated with the drug itself or by transferring someone else's sweat from a handshake or other contact.

The Intelligent Fingerprinting technique has built-in features that deal with these challenges. Firstly, the technique works by detecting metabolites of the target drugs, thereby directly showing evidence of the body's ingestion of the drug. This means that

a positive result can't be obtained from contamination of the fingerprint by touching a surface coated with the parent drug itself.

Secondly, the metabolites are detected in direct association with the sweat pores themselves, thereby uniquely linking the positive result to the owner of the fingerprint itself. Transferring sweat-containing drug metabolites from another person would not give this direct link, making this technique immune from the problems of secondary transfer of metabolite contamination.

POLICING

The potential uses of the Intelligent Fingerprinting technique within policing include the following:

- Provision of intelligence from latent crime-scene fingerprints to help build an offender profile, particularly in major and critical incidents
- Rapid and easy determination of the presence of banned substances to corroborate an allegation of impaired driving as part of roadside screening
- Test on arrest within police custody procedures to both corroborate allegations of drug use and to inform health and safety issues around detention of arrestees

In addition to these, it's possible that this detection technique could be used as a fingerprint enhancement technique in its own right.

BORDER CONTROL AND NATIONAL SECURITY

In light of recent terrorist attacks, air and seaport security has become a primary focus for improvement. New passenger-screening techniques have been developed to assist in the detection of explosive devices and other weapons, but there's an increasing need to carry out targeted enhanced screening as well.

This new technique combines rapid fingerprint biometric identification along with the metabolite analysis techniques that could be routinely incorporated into boarding procedures to identify individuals who might have had recent contact with explosives, or who might be concealing an explosive device in their bodies.

INSTITUTIONAL TESTING

Routine screening for drug abuse is often mandatory for prison populations, the military and commercial companies with legislated health and safety requirements for a drug-free workplace.

Current testing systems often have restrictions on their usefulness because of the need to collect invasive and hazardous samples, the problems associated with maintaining a secure chain of evidence, or the ability of the tested individual to cheat the system through substituting someone else's sample for their own.

This process offers a new testing mechanism that tackles all of these problems. With the development of the hand-held testing device, it can also provide a mobile testing solution to determine whether someone is fit to work.

MOBILE ANALYSIS

In addition to the sample collection and analysis kit, Intelligent Fingerprinting has developed a prototype hand-held sample collection and analysis device. This portable device uses novel micro-fluidics and optics that can allow the analysis for drugs of abuse and the imaging of the donor's fingerprints in a matter of minutes using a disposable sample-analysis cartridge.

The use of different cartridges enables testing for drugs specific to the particular operational requirement, and researchers are developing a way to allow the fingerprint image to be exported in a digital format to enable searching against fingerprint databases for identification purposes. ■

A prototype of the Intelligent Fingerprinting hand-held sample collection and analysis device. The production version of this mobile device is scheduled for release at the end of 2012.

