

Detect the undetectable: Newly developed test allows to screen for the presence of drugs based on drug activity

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"Looks don't matter, it's what you do that counts." This quote from Skipper, from "Penguins of Madagascar" is the general theme throughout the work of Annelies Cannaeert, a Ph.D. student at the Laboratory of Toxicology at Ghent University, Belgium. Annelies, who will defend her Ph.D. thesis on May 25th, developed a novel concept to detect so-called 'designer drugs.' Rather than being based on a compound's structure, as conventional methods do, the alternative concept utilizes a compound's activity. This makes it possible to screen for the presence of drugs, even without knowing a drug's identity.

Very recently, this novel [concept](#) was used to screen large sets of biological samples for the presence of [designer drugs](#) with cannabinoid or opioid activity, with very promising results: only few samples in which drugs were present were missed, whereas there were hardly any samples that were wrongly scored positive. This new concept makes it possible to screen for the presence of all current and future drugs belonging to certain [drug](#) classes, without the need to know a drug's identity.

The newly developed test is the first to use living cell cultures as a screening tool in forensic toxicology. Cells were manipulated in such a way in the lab that they express the actual targets of the illegal drugs: the receptors via which cannabis, morphine or related molecules act. When an extract of a blood or urine [sample](#) is brought onto these cells, an

advanced mechanism is triggered within the cell. Interesting and relevant in this context is that this mechanism is based upon what happens in human brain cells upon use of these substances. In the end, a light signal is generated, which can easily be monitored.

The test offers the advantage that not only all currently known active compounds with cannabinoid or opioid activity can be monitored, but also all future products. This short-circuits the continuous attempts of illicit manufacturers to develop new compounds that cannot be detected and/or are not scheduled but that are often even more powerful and dangerous than the conventional drugs. This is important because of the possibly deterrent effect of "traceability": with the new technique, the presence of compounds that are non-detectable or hardly detectable using conventional strategies can now effectively be demonstrated.

The problem of new psychoactive substances

During the last few years the rise of "designer drugs," also coined new psychoactive substances (NPSs) has resulted in an explosive growth in the number of compounds available on the illegal drug market. These NPS are often based on the chemical structure of illegal or prescribed drugs, with slight modifications, so they're still active, but are possibly no longer scheduled. Moreover, the large structural diversity makes it very challenging -if not impossible- for toxicological laboratories to screen for all these compounds via the conventionally applied techniques. Especially the class of synthetic cannabinoids and synthetic opioids pose a problem. These are substances of which the effect resembles that of cannabis or opium, but which are structurally very divergent from the active substances from cannabis or opium.

Importantly, several of these [compounds](#) are so potent that they are not only responsible for (potentially fatal) intoxications, but are also active at very low -and hence hard to detect- concentrations. The extent of the problem is clear in the US, where an opioid crisis is currently ongoing.

Amongst the many thousands of deaths as a result of drug abuse, there is an important role for synthetic opioids.

For the actual development of the new concept of activity-based screening, Annelies readily received a prestigious award from the European Monitoring Centre for Drugs and Drug Addiction. Since then, in collaboration with many national and international laboratories, many hundreds of samples were tested using the newly developed technology. The obtained results were so promising that it is currently being explored how the concept could be more widely applied. Especially large, centralized laboratories that perform drug screening of large panels of samples, may benefit from implementation of this novel concept.

More information: Annelies Cannaert et al. Detection and Activity Profiling of Synthetic Cannabinoids and Their Metabolites with a Newly Developed Bioassay, *Analytical Chemistry* (2016). [DOI: 10.1021/acs.analchem.6b02600](https://doi.org/10.1021/acs.analchem.6b02600)

Provided by Ghent University

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