

# Doping test gotcha with retroactive effect

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A doping test which sees everything, even banned substances which we don't know about yet. It sounds like something from science fiction. But it exists.

Professor Michel Nielen from RIKILT, part of Wageningen University, The Netherlands, who developed this test, writes about it with his co-authors in the journal *Rapid Communications in [Mass Spectrometry](#)*. The test was commissioned by the anti-doping agency WADA and developed together with Greek co-workers. It started as a research proposal submitted to WADA by Nielen and his colleagues five years ago. 'Our plan was to analyze doping samples in another way', explains Nielen. The current methods have certain disadvantages. 'One problem is that new substances keep showing up, which keeps calling for new detection methods. That results continuously in more work and higher costs.'

Nielen thought that things could be better, cheaper and faster. Perhaps the most important aspect of his test is that it would have a preventive effect. The test would be able to apprehend delinquent athletes retroactively. Even years after the act. The core of Nielen's method is a special form of mass spectrometry, the so-called time-of-flight-mass spectrometry (TOF-MS). [Molecules](#) are separated in this way from one another by weight, based on the time that they need to cover a certain distance in a vacuum pipe. 'Each charged particle acquires exactly the same amount of energy. It's as if we give all of them exactly the same shove in their backs. The heavy [particles](#) attain less speed than the lighter particles and take a longer time to travel, and bear fruit longer.'

The big advantage of TOF-MS is that the entire spectrum of molecules is visible all together. The classic MS, according to Nielen, does not have this. 'Moreover, it zooms in on a few mass signals of known substances. That is, in fact, like searching for several known [trees](#) in the entire forest. Our method sees the entire forest, including the yet-to-be discovered trees.'

Nielen's method detects 241 items on the WADA list of banned substances, which make up eighty percent of the smaller molecules on this list. Nielen: 'Together with GC-TOF - gas chromatography combined with TOF-MS - the remaining gap of 20 percent will be covered. That leaves only the big protein-like substances such as growth hormones and EPO which cannot be detected by this method.'

More importantly, the mass spectrograph can also spot substances which are not yet on the WADA list, simply because they are still unknown to anti-doping authorities. Nielen: 'You can therefore go back to view old data to see if a recently discovered tree was already in the forest then.' Nielen and his co-workers have shown that this works. In doping samples of the WADA, the designer drug 4-methyl-2-hexanamine was found. It would appear that athletes who were thought to be 'clean' would then had been tested positive. Athletes (and animal keepers) can thus be apprehended with retroactive effect. And that, says Nielsen, is a major preventive measure in the strife against doping.

Provided by Wageningen University

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