

# CULTEX<sup>®</sup>, the canary of the 21st century

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**Exposure to toxic substances through inhalation – that is one of the health risks that confront soldiers (and others) during military exercises. Monitoring the quality of the ambient air is therefore essential. TNO has been investigating the extent to which the CULTEX<sup>®</sup> system can be used to this end.**

Various technologies are available for establishing the composition of the ambient air. 'And subsequently the toxicity of this air has to be determined,' explains Marcel Alblas, chemical researcher. 'This is fairly straightforward for simple substances but this tends not to be the case in practice where mixtures of toxic substances occur and predicting the level of toxicity of this mixture is still fairly unexplored territory.'

A better method is therefore to screen the toxicity of the ambient air using a biological sensor. His colleague Dorien Wijte says: 'This sensor will warn if the ambient air is toxic so that appropriate measures can be taken. Then it can be established which toxic substances are present in the air. It works in a similar way as the canary in the coal mine principle.'

## CULTURED CELLS

Ethical and practical objections preclude the use of living animals as biological sensors. Research into animal substitution methods within toxicology, however, reveal that for several applications cultured human cells can be used.

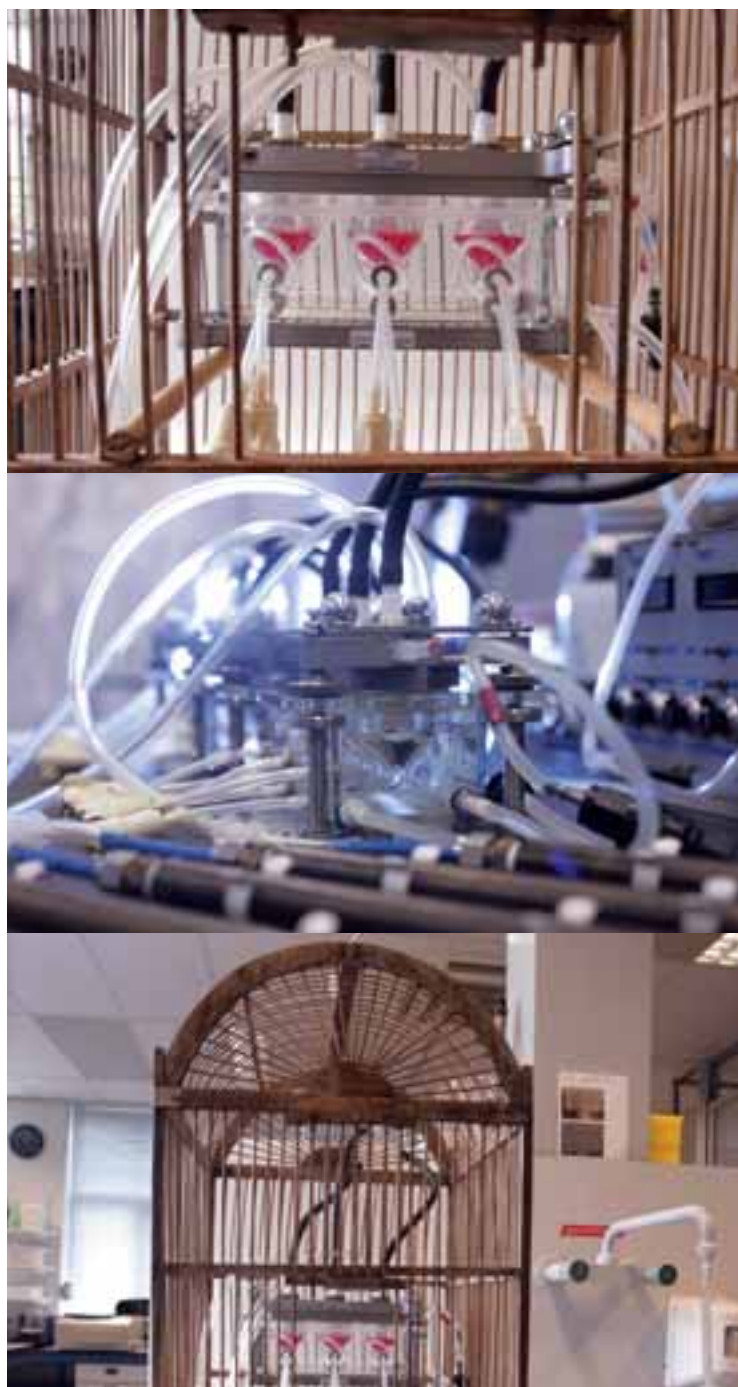
A number of years ago, the German Fraunhofer-Institut developed the CULTEX<sup>®</sup> system when investigating the impact of tobacco smoke on health. Cultured human lung cells were exposed to air samples and the toxic effect on the cells measured according to various biomedical parameters that are indicative of the state of health.

Alblas: 'We have been examining the extent to which the CULTEX<sup>®</sup> system can be used as a *canary* to screen toxic substances in the ambient air. If you expose lung cells separately to various concentrations of nitrous oxide and ammonia, harmful effects on the cells occur only after exposure to the kind of concentrations that would cause serious damage to human health. In other words, the system is not sensitive enough to be used as a canary in this case. Yet when we expose the lung cells to mixtures of nitrous oxide and ammonia in various ratios, the harmful effects occur upon concentrations that are considerably lower than during exposure to the individual substances. That would suggest that the CULTEX<sup>®</sup> system is indeed highly suitable for detecting the toxicity of mixtures.' Wijte adds, 'Clearly the toxicity of the mixture is higher than the sum of the toxicity of the individual substances.'

## CIVILIAN PROJECTS

Proof has thus been provided for this method as a suitable way of screening the ambient air for toxicity. Wijte: 'Unfortunately, the CULTEX<sup>®</sup> system is too complex and insufficiently robust for use in military operations but it is an excellent research tool.'

The system is currently being employed to assess the toxicity of coloured military smoke. It has also been used in several civilian projects with other TNO core areas to establish the toxicity of



particulates, biodiesel exhaust gas, candle combustion products and products that released when hamburgers are grilled. 'The CULTEX<sup>®</sup> system is now mobile,' Alblas adds, 'so we can expose the cultured lung cells to the ambient air under investigation on the spot.'

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